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Advertisement Index, see page xl.

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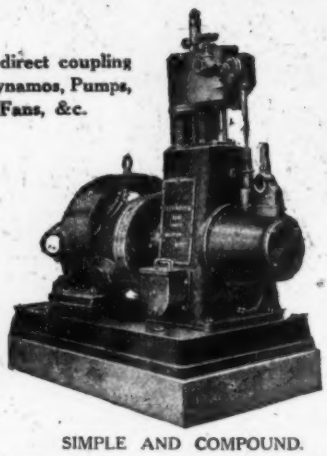

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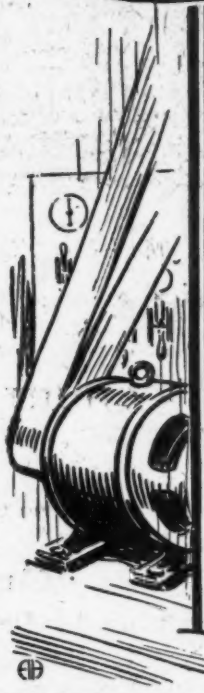

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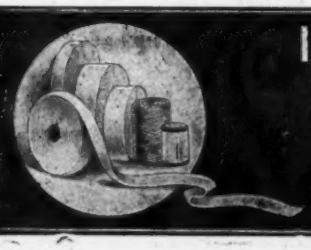

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ELECTRICAL REVIEW.

VOL. XC. MARCH 17, 1922. No. 2,312.

ELECTRICAL REVIEW.

Vol. XC.] CONTENTS: March 17th, 1922. [No. 2,312.

	Page
The Lock-out of the Engineers	361
Form K Cable Code	362
The Electricity Supply Bill	362
Universities Educating the Public	363
The Situation of the German Electrical Industry	363
Canadian Hydro-electric Power	363
The Whitley System in Electricity Supply	364
The Authority of the Electricity Commissioners, by W. S. Kennedy	365
The Two-wattmeter Method of Measuring Power, by G. W. Stubbings	366
Industrial Lighting	366
English Electric Rotary Converters (*illus.*)	367
New Electrical Devices, Fittings, and Plant (*illus.*)	368
Legal	369
Reviews	370
The Institution of Electrical Engineers (*continued*)	371
The Hydro-electric Power Commission of Ontario	371
Parliamentary Notes	372
Business Notes	372
Notes	378
City Notes	383
Stocks and Shares	386
Cable Charts and Cable Calculations (*illus.*)	387
High-power Mercury Arc Rectifiers, by R. L Morrison (*illus.*) (*continued*)	388
Rotary Converters: with Special Reference to Railway Electrification, by F. P. Whitaker	391
The Ideal Home Exhibition and Welwyn Garden City (*concluded*)	393
Correspondence—	
The Fetish of the Quick-make and Quick-break Switch	394
Cooling Systems for Liquid Controllers	395
Christianity and Industry	395
Charges for Services	395
New Patents	396
Published Specifications	396
Contractors' Column	Advertisement page xxviii

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THE LOCK-OUT OF THE ENGINEERS.

SINCE we last commented upon the dispute in the engineering industry the situation has materially changed, and changed for the worse. It will be remembered that a majority out of approximately one-fifth of the membership of the A.E.U., decided upon the rejection of the terms agreed upon between the employers and the representatives of the Union. Successful efforts were made to bring about a resumption of negotiations, but no accommodation was arrived at. The men proposed to drop the important provision that "instructions of the management shall be obeyed pending any question in connection therewith being discussed in accordance with the provisions referred to," and in substitution for the clause providing that the Union should not interfere with the employers' right to exercise managerial functions, and that the employers should not interfere with the Union's proper functions, it was proposed that "the right of the employers to exercise managerial functions shall continue as hitherto," the Union retaining the right to continue to perform its proper functions.

Here, of course, a vital change of front is observable. It is clear that the men must have considered that the right of the employers to manage their works needed some safeguard from their point of view. The employers said: "We want the right to manage without interference from the Union," and to this the executive agreed. Both parties, then, in November, 1921, were at one in the view that there was at that time interference with what the employers regarded as their functions; and it cannot be doubted that in conversation and discussion, the nature, scope, and limitations of that interference were thoroughly looked into. A four-fifths majority of the membership of the Union listlessly allowed the opportunity of expressing their views upon a matter which affected them vitally to pass by, so that the irreconcilable minority, as always, had its way. The agreed terms were turned down. In passing we would remark that it appears quite as logical to consider that the non-voters were in favour of the terms as to consider that they were in favour of their rejection, which is what the present situation amounts to. It might possibly have the effect of stirring up the laggards if it were arranged, in any case of the kind, that those who would not take the trouble to vote would be held to have voted in favour of the settlement; or it would perhaps be possible to enact that a vote of less than 51 per cent. of the membership in favour of any particular course of action should be regarded as indecisive, and the question should be put to the membership again. Mr. Clynes, who generally knows what he is talking about in labour matters, gave it as his opinion that another ballot should be taken in the present case, provided that the employers would consent to a postponement of the notices, as we think they would have done.

To resume—the reply of the men has been altered from consent to managerial functions remaining in the hands of the employers, to "the right shall continue as hitherto." On being asked what this meant, private consideration lasting an hour produced the reply that only the war-time agreements were contemplated; or, in their own words, "That we inform the employers that under our proposals instructions will be observed in the same way as from the date of the York memorandum, 1914, and existing agreements." From "we will not

interfere," they had come to "we will not interfere more than we have been doing for the last seven or eight years"; so that the position which the executive must be taken to have agreed to regard as intolerable was to be continued.

Moreover, overtime was to be limited to the trifling amount of 30 hours per month, and not only so, but the men who worked overtime were to have equivalent time off, to provide that men should not work more than the normal number of hours per week. That means that, in certain emergencies, in a normal month's work, thirty hours would be paid for at time-and-a-half. There would clearly be no increased output, for the whole argument in favour of a reduction of hours was that long working periods only exhausted the worker and did not increase production. During overtime, then, efficiency would be low, and costs would be high; and men were to have several days of fully-productive and less expensive time compulsorily docked, so that any beneficial result that might have been obtained should be nullified.

This is "'ca' canny" in its worst form. It must surely be abundantly clear to the men that unless works are being run on a reasonably high level of production, it will not pay employers to keep them open at all. Overhead charges increase disproportionately when output falls off, and the works might as well be shut down as run at a loss. When they are shut down there is at least no expenditure on power and light, and we are quite prepared to learn that the permanent staffs will be reduced or suspended if the interruption lasts long. This contingency was only narrowly avoided during the coal stoppage last year. We are not now suggesting that the staff should receive more consideration than the manual workers. We only wish to make it clear that the employers have a number of methods of effecting economies which have not yet been exploited, and they will not hesitate to use them. There are already instances in which staffs have been reduced and the survivors made to work overtime for a night a week, and there is no time-and-a-half about it, either. The staff workers are invited to think themselves lucky to be in a job at all.

The fact that the lock-out has already begun cannot fail to have an exacerbating tendency, not only on the engineering trouble, but on the shipbuilding and the dockers' negotiations. Nevertheless, having been shown that the employers are in earnest, the Union should, we urge, arrange another ballot, and see that the members record their votes. The word "ballot" means a secret method of voting, and of course the voting must be secret, so that there may be a free expression of views, with no intimidation or victimisation.

On the other hand, it must not be forgotten that engineers have been for a long time miserably badly paid as compared with workers in some other trades. Skilled men in this, one of the most important of key industries, are paid less than unskilled workers in some industries of no greater importance. Engineering employers, therefore, should make allowance for the conservatism of the men whose comfort, whose very means of existence, is regarded as threatened by any improved method of production. The fear of unemployment is a very terrible fear, and we are sorry to see unemployment deliberately inflicted upon a large number of the best workers of the country—of the world, in fact—by the employers in an industry in which the need for an enlightened policy of strenuous advancement was never greater than at the present time. Every effort should be concentrated on meeting foreign competition. It is not only by research and the endowment of brains that progress is to be made. The capable leading of the multitude of workers is even more necessary. What is happening in those works in which works committees have been functioning for years? Have they no word of guidance in the present darkness? If they have, then in the name of humanity let them speak it now.

Form K Cable Code.

One branch of activity of the Department of Overseas Trade is connected with what is known as Form K. This form consists of a questionnaire relative to the lines of goods dealt in by prospective oversea buyers and a few other details of utility to the United Kingdom exporter. The information thus collected by H.M. Trade Commissioners, Commercial Secretaries and Consuls abroad is circulated amongst approved recipients in such a way as to prevent unauthorised persons from obtaining advantage from it. Under the method adopted, the questions on the Form are numbered, whilst on the replies only the number is given by the side of the reply. No one but the Departmental Officers and the approved recipient has the key to the questions, and by this means the replies are kept confidential. From an announcement made in *The Times Trade Supplement* it appears that Admiral Henry Campbell has devised a system by which a greatly extended use could be made of Form K at a minimum expense. By classifying numerically the chief import and export commodities and applying a special code to them and to the Form K questionnaire Admiral Campbell has provided a very economical cable code by which inquiries may be rapidly transmitted to British merchants and manufacturers. It is to be hoped that good use may be made of it.

The Electricity Supply Bill.

As in the case of the original Bill of 1919, the opposition to the Electricity (Supply) Bill in the House of Lords is largely based upon misconception of the intention of the Bill and ignorance of the actual circumstances. Lord Bessborough, for instance, suggested that the local inquiries held by the Electricity Commissioners had been, so far, fruitless, that not a single order had been issued for any of the schemes that they had propounded, and that not a single scheme had been accepted by any of the local authorities concerned, which is contrary to the facts, as our readers know. Again, he declared that the London inquiry had had no result, a statement which was equally erroneous. Whatever the source of his misinformation, it is deplorable that the work of the Commissioners should be so grossly misrepresented. Lord Haldane recognised the urgent necessity for passing the Bill, as would be expected, he having been chairman of the Coal Conservation Sub-committee, whose report gave rise to the Act of 1919; but Lord Buckmaster's speech was a travesty of the facts, for he wholly ignored the control of the Minister of Health over the borrowing powers of local authorities provided for in the Bill, and stated that the local authorities would be able to do whatever they pleased in giving financial assistance to the Joint Electricity Authority, which itself, by Section 1, must obtain the sanction of the Electricity Commissioners to the loan and to the terms of repayment. Moreover, he said that schemes promoted under the Bill would not have to go before Parliament; this is incorrect, for every such Order made by the Commissioners must necessarily be approved by Parliament, in accordance with the Act of 1919. The Marquess of Salisbury also wrongly assumed that local authorities would have a free hand, and that the Bill would increase the burden of rates. The local authorities will have no more liberty than they have at present, when every capital outlay has to be sanctioned by the Electricity Commissioners.

With regard to private enterprise, as we pointed out last week, the Bill goes a long way to safeguard the interests of power companies, and legalises the alliance of municipalities and companies, on lines which have long been followed with success on the Continent and elsewhere. A torrent of uninformed but highly imaginative abuse has been poured upon the Bill by a financial organ, acting ostensibly in the interests of private enterprise under the cloak of economy—but really advocating precisely the reverse; it would allow

"the existing companies and municipal authorities to carry on in the future as they have so ably done in the past"—the old story—what was good enough for our fathers must be good enough for us. But we have it on most excellent authority, both municipal and company, that immense savings of capital will be effected by the co-ordination and co-operation which will be made possible only by the passing of this Bill. In this connection we are glad to note that Sir Harry Renwick on Tuesday last paid a well-earned tribute to the great services which the Electricity Commissioners are rendering to the community, and we cordially endorse his remark that "all who have the real interests of the industry at heart will give Sir John Snell and his colleagues their most loyal support."

Universities Educating the Public.

The modern university is in closer touch with the public than the older institutions, and possesses great potentialities for promoting the welfare of British industries, quite apart from its normal work in the class-rooms and laboratories. Two instances of the ways in which public service can be rendered have recently come under our notice, both, as it happens, emanating from Yorkshire, but both being typical of similar functions fulfilled by universities situated elsewhere.

In an interesting paper read before the Royal Society of Arts by Mr. E. V. Evans, F.I.C., on problems in the gas industry, special reference was made to the work of the University of Leeds in the conduct of investigations relating to the chemistry of gas manufacture, in conjunction with the Institution of Gas Engineers; and at Sheffield University the Department of Applied Science last week made a special effort to awaken the interest of the cutlery and tool-making trades in modern methods of heat-treatment of steel. How necessary this is may be judged from the fact that these trades, in which Sheffield leads the world, have centuries of tradition and custom at their backs, and it is only with the greatest difficulty that a new process can be introduced. When stainless steel was first placed on the market, it acquired a bad name for domestic cutlery, because the cutlers insisted on following the methods of hardening and tempering which they knew to be successful with ordinary steels, and it took some years for the manufacturers of stainless steel to make them understand that that material required wholly different treatment. As we recently explained, stainless steel is not only as good as, but much better than, ordinary steel for numerous applications—provided that the appropriate heat treatment is adopted.

The Sheffield demonstration was open to the public, and workers were invited to bring their own samples of knives, razors, &c., for hardening. An automatic electric hardening furnace was at work, as well as muffle furnaces heated with coke, but the former, which gives absolute certainty of attaining the desired results (using the change-point indicated by the loss of magnetism as an infallible guide) was naturally, may we say, the *pièce de résistance*. The electric hardening furnace is less expensive than gas furnaces, and gives better results; and by pressing these facts upon the attention of the manufacturers, who cannot hope to compete successfully with their foreign rivals unless they adopt up-to-date methods, the University of Sheffield is performing excellent work.

The Situation of the German Electrical Industry.

Herr Karl Friedrich von Siemens, addressing the shareholders in the Siemens & Halske Co. at the recent annual meeting, stated that as a result of the quiet labour conditions in 1920-21, it was possible to calculate with greater certainty and thus reduce prices and at least quote fixed prices for those articles which did not require a long time for production. All hopes associated with this quieter development were all at once destroyed at the end of the financial year through the fall in the mark, and a chaos had occurred in economic calculations, which was much greater than had ever previously existed. The directors had believed that they ought to limit the dividend to a rate of 20 per cent. Applied to the nominal value of the shares, this corresponded to a yield of only 0.4 per cent. in gold and a yield of 1.8 per cent. in paper according to the share quotation for the day. In reaching this decision the directors had taken into consideration future periods, and had held back the funds as far as possible. It was necessary to overtake what had been neglected during the war and the period of the revolution, and this policy was in the true interest of the shareholders. The company had already begun to adapt a number of antiquated installations to present requirements. Although the electrical engineering firms in general had prevented the sale abroad of German manufactures at "slaughter" prices, seeing that they had adjusted themselves to the market prices in the individual countries, they had been compelled to notice that the price difference in no way corresponded to the difference between the inland and foreign purchasing power of the mark. This was to be attributed in some measure to the circumstance that the scarcity of orders in other countries had led to a reduction in sale prices, but it was due for the most part to the still declining efficiency of German economy. The chairman stated in this connection that he was convinced that under equal conditions, such as formerly existed between other countries, German industry would at present no longer be able to compete in the world's markets.

This inadequate economic force was at present only veiled by the difference between the outer and the inner purchasing power of the mark. As to the new financial year, Herr Siemens remarked that the first months had been under the influence of the exchange. Customers, who had hoped for a further reduction in prices and had therefore withheld their orders, then came forward to avail themselves of the low prices still prevailing, and the orders booked were consequently considerable, so that most of the company's departments would be fully occupied for months forward. In conclusion, he remarked that it naturally could not be foreseen how conditions would develop in connection with the further depreciation of the mark.

Canadian Hydro-electric Power.

Although the Hydro-electric Power Commission of Ontario has had so successful a career, and has developed the use of electricity to such an enormous extent within the area which it serves, its path is not altogether free from obstacles and difficulties. As recorded in our "Notes from Canada," it had planned a system of electric railways connecting important centres, which had received the cordial approval of the inhabitants of the towns concerned, but a Royal Commission of Inquiry appointed by the Provincial Government reported adversely to the scheme, and the Government consequently withheld its support, to the great indignation of the local municipalities.

Since then, further trouble has arisen, owing to the outlay on the Queenston-Chippawa Power Development having greatly exceeded the anticipated amount. As mentioned in our last issue, there was an excess expenditure last year over the estimates of the Hydro-electric Power Commission of no less than three millions sterling; as a result of this, Colonel Carmichael has resigned his membership of the Commission, and it is expected that Sir Adam Beck will cease to be chairman. The Commission controls a total capital investment amounting to over 72 million dollars, say, 15 millions sterling (October, 1920), which by now must have been considerably increased, and comprises five members, including the secretary and the chief engineer; it has magnificent achievements to its credit, but recent events render it probable that its constitution will be changed, and that its operations will be brought more directly under Government control.

D

THE WHITLEY SYSTEM IN ELECTRICITY SUPPLY.

WORKS COMMITTEES.

The National Industrial Council, with the concurrence of the thirteen District Councils, has recommended the setting up of Works Committees in individual undertakings, and has issued a constitution giving the broad lines on which these should be formed. Up to the present this recommendation has been very inadequately responded to. There seems to be a feeling that these Works Committees are a matter of subordinate and indeed unimportant detail, hence the general inactivity in this matter.

The assumption is fundamentally wrong. Works Committees are an integral part of the Whitley system; indeed, when Works Committees play no part the scheme is in a most imperfect form and rests on a very insecure foundation. The Whitley scheme assumes Works Committees to be the foundation; the superstructure is the District Councils and the National Council. Without Works Committees the motive underlying the whole Whitley proposal cannot be carried out.

The whole idea of the Whitley system is to establish and continue good relations between employers and employed. In so far as the National Council and the District Councils arbitrate on fair rates of pay and proper working conditions, so far this end is achieved, but beyond this it is obvious that District Councils cannot go. The contact between employers and employed through the National Council or the District Councils is only between certain employers' representatives and the Trade Unions' executives or officials. There is no direct relationship for good or evil established between the employer and employed in any individual undertaking. Obviously, therefore, in this respect the present scheme in the electricity supply industry fails. Such direct relationship can obviously only be obtained by an organisation *inside* the undertaking, and this is the reason why the Works Committee is an important part of the Whitley system. The new relationship which the Whitley Report seeks to establish between the two sides is a relationship between the individual employé and the individual employer, and it postulates that this can only be done by their being brought into intimate contact, and this intimate contact, it considers, is best attained through a Works Committee.

In the electricity supply industry we first formed a National Council and then formed District Councils, and last of all, instead of primarily, proceeded to form Works Committees. Although this was theoretically wrong, still, in the circumstances, it was the only way to set to work. The industry was in a state of chaos so far as industrial organisation was concerned, and certainly as regarded wages and working conditions. It was only by working from the top that the last two items could be reduced to some sort of order. That practically complete order has been instituted, so far as wages and working conditions are concerned throughout the whole electricity supply industry, is the outstanding achievement of the National Council and the District Councils, a successful achievement which seems to have no parallel in the Whitley Council of any other industry. Had the establishment of Works Committees been undertaken at the outset while there was such universal dissatisfaction over anomalies in wages and working conditions, the result might have been most embarrassing, and indeed hindering, to the work of the District Councils. At the present time, however, now that the ground has been cleared in this respect, there is the more pressing urgency for Works Committees to be formed. In the first place, unless this is done there is a certain amount of danger that the whole Whitley scheme will slow down. The National Council has done its chief work, and the District Councils are now engaged on clearing up and settling detail. But the nearer one gets to order and system in wages and working conditions throughout the industry the more will the *rationale* of the National Council and the District Councils be reduced. There is, indeed, a danger of this fine organisation dropping into a kind of "sleeping sickness." Its chief duty will apparently have been done, and there will be a tendency for it to gradually cease to be an important factor in the industry. This weakness is due to its being looked upon somewhat as an *ad hoc* body instead of being an organic part of the industry, and this because the basal third estate (the Works Committee) is missing.

However well the Whitley system in the electricity supply industry has dealt with wages and working conditions, it has done nothing in establishing a medium for direct relationships between individual employers and employed. The point of contact has not only been merely between the Trades Unions and the employers' representatives, but in certain cases the actual Trade Union representatives are not even in the industry, being either officials or engaged in some other trade. This means, of course, that the individual employé is connected with his District Council only through his Trade Union. The employé naturally gets to look on the District Council as a kind of fighting ground to which he sends the champion of his cause, quite an alien spirit to that assumed by the Whitley Report. He can indeed know nothing about what takes place at the meetings of the Whitley Councils, except through these Trade Union channels. All the good relationship which comes from direct intercourse with the employers through a Works Committee is entirely lacking.

Under the present truncated Whitley system, in spite of the apparent general concord, there may even at this moment be a deplorable atmosphere of seething discontent and suspicion among the employés of any one undertaking, a state of affairs which it is the special duty of the Works Committee to counteract. Moreover, the necessity for Works Committees, and a hopeful future for them, is much greater in the electricity supply industry than probably in any other industry. In many industries there is a constant change of *personnel*, but in the electricity supply industry ,the permanency of employment affords specially good condtions for the forming of permanent good relations through Works Committees. The good results are, so to speak, carried forward, since the staff is practically the same year after year.

Again, the formation of Works Committees is a right step in the direction of devolution. There has been considerable talk lately of the over-organisation of Trade Unions by which the Executive gets an entirely autocratic control and the individual worker becomes a negligible factor. Now, in sectionalising, by way of Works Committees, the views and influence of the individual workers are obviously given an altogether new channel through which to work. (This does not mean that Works Committees would be in the slightest degree inimical to the Trade Unions; quite the reverse, as the members of the Works Committees could be chosen on a Trade Union basis, and, of course, work fully in harmony with their local Trade Union organisation.) The Whitley scheme, in fact, pre-supposes the desirability of such devolution, but it can only be carried out when Works Committees become a part of the organisation.

As to the structure of the Whitley scheme being incomplete without the Works Committees, it is obvious that when the scheme depends for its sub-structure and support on a large number of Works Committees, composed of both sides, it is in a much more stable condition than when it practically depends upon merely Trade Union executives and employers' associations as at present.

The incidental advantages of Works Committees, so far as the individual undertaking is concerned, are another matter. There are quite sufficient advantages to warrant the establishment of Works Committees irrespective of their forming part of the Whitley scheme, but the foregoing notes deal with the Works Committees as an integral part of the Whitley scheme in the electricity supply industry.

THE AUTHORITY OF THE ELECTRICITY COMMISSIONERS.

By W. S. KENNEDY.

Some Legal Questions under the Act of 1919.

The Electricity Supply Act, 1919, provides (Sec. 11) that, notwithstanding any provisions of any special Act, it shall not be lawful for any authority, company, or person to establish a new, or extend an existing, generating station without the consent of the Electricity Commissioners. The Commissioners may not refuse consent nor impose conditions to which objection is raised unless they have held a local inquiry into the matter.

It has been suggested that this provision is the expression only of a threat which cannot be carried out, and that a local authority or company undertaker disregarding it has nothing to face but the moral disapproval of the Commissioners. This view—presumably based on the absence in the statute in question of any specific penalty for disobedience—is not borne out by the authorities, nor is it one which could commend itself to any lawyer. The law may deserve—frequently does deserve—many of the hard things said about it, but it is not so futile as not to be able to prevent that being done which is expressly declared unlawful where prevention seems desirable or necessary.

The object of a statute is ultimately to declare the resolution of the Legislature—the supreme authority—that people should do or refrain from doing certain particular acts. In certain cases the statute sets out the procedure for its own enforcement, and lays down the penalties which may be exacted by the Courts for disobedience. In such cases, *prima facie*, such procedure must be adopted, and such penalty is the only one which can be enforced. But this rule is subject to exceptions, so that even here the residuary power of the law, so to speak, is not exhausted.

Where the means of enforcement are not provided in the statute—as in the case under consideration—the Legislature has assumed that the ordinary law is sufficient to ensure obedience to its decrees: an assumption which finds expression in the legal maxim, "*ubi jusibi remedium.*" At common law a breach of a statutory command is, in the absence of special provisions, indictable as a misdemeanour. The authorities in support of this proposition are numerous and need not here be cited at length; they may be found in the Encyclopædia of the laws of England under the title "Statute," where much information on the subject is collected. A distinction may be drawn between violations of statutory duties which deal with private rights and those which affect the public at large. Into the former it is not necessary here to inquire, since the decision of a company or a local authority to build or extend a generating station in defiance of a ruling of the Commissioners is undoubtedly a public matter. In such a case, in addition to the common law remedy of indictment, application may be made to the High Court by the Attorney-General for an injunction to restrain the breach of a statutory duty. Such an application might, it is submitted, be made either *ex officio* by the Attorney-General or at the instance of the Commissioners or any party who was aggrieved by the proposed action—even the local gas company might have something to say, though its application might not be listened to with so much respect as not being entirely disinterested. It would be no answer to such an application that the action proposed to be taken by the respondent was ultimately or even immediately for the public good, for it has been decided in the case of "A. G. *v.* London and North-Western Railway" [1900 1 Q.B. 78] that where violation of the provisions of the statute is shown—or, as it must be in the given case, admitted—it is not for the Court to question the wisdom of the Legislature in enacting such provisions, but simply to see that they are obeyed.

In the case referred to, Lord Justice A. L. Smith quoted, with approval, two earlier judgments with regard to railway companies, and those judgments seem so apt that the quoted passages may usefully be reproduced here. The first was from the case of "A.G. *v.* Great Eastern Railway (11 Ch. Div. 449), where Lord Justice James said:—"Where a company entrusted with large powers is deliberately violating an express enactment or disregarding an express prohibition of the Legislature, it is really committing a misdemeanour, and ought to be at once stopped." The second passage is from an older judgment of Vice-Chancellor Wickens in "A.G. *v.* Great Western Railway" (L.R. 7 Ch. 767) in the following words:—"It is said that the unsanctioned alteration is an improvement and tends to the greater safety and advantage of the public; but in my opinion that is a matter with which we have nothing to do."

The Great Eastern case turned largely on the facts, but the Judges in all three cases agreed that a deliberate violation of a statute is a thing which must be prevented, and it may be inferred that it is *ex officio* the duty of the Attorney-General to prevent it, and certainly his duty so to do if warned by any person having the requisite interest. The Court has, of course, discretion whether it will in any particular case grant an injunction. If the disobedience were slight and non-continuous, possibly it would not; but such a direct defiance of the law as has here been contemplated would assuredly not be treated lightly.

There is another aspect of such a case which must not be overlooked. It was laid down many years ago by Lord Ellenborough in the case of "Langton *v.* Hughes" [1 M. & S. 593], and indeed is accepted law, that what is done in contravention of an Act of Parliament cannot be made the subject of an action at law. A transaction carried out in violation of a statute is *prima facie* illegal and void. No action would lie for the enforcement of any contract which involved the carrying out of such an illegal act or was involved in it, although possibly a party who was not privy to the illegality nor cognisant of it might recover; *e.g.*, for goods actually supplied. Thus, if a local authority entered into a contract to erect or extend a generating station without the consent of the Commissioners, while it is possible that it might be used on such a contract, it could not itself enforce it. This in itself should be sufficient to prevent rash action on the part of undertakers dissatisfied with any decision of the Commissioners.

Foreign Competition.—In his speech at the annual meeting of the British Mannesmann Tube Co., Ltd., Mr. Richard S. Guinness, who presided, said that in their profits there was a decrease of some £95,000 largely owing to the heavy depreciation of trading stocks. During the first half of the year operations had been very successful, but in the second half-year the company had suffered much from depression in trade, with the consequent cutting of selling prices. They had, however, through all the bad times, and right up to the present, been able to keep their works in operation, although output showed a considerable falling away. Owing to the present economic position, British manufacturers were under a serious disadvantage as compared with foreign competitors. It was to be hoped that before long that extraordinary state of affairs would be remedied either by economic laws or by international arrangements, and that, in consequence, the abnormal foreign competition to which they were being subjected, both in the home markets and abroad, might find its proper level. They might then be able once again to compete on equal terms with any foreign country. Orders were both scarce and very keenly competed for, and it was difficult to see any signs of encouragement at present.

THE TWO-WATTMETER METHOD OF MEASURING POWER.

By G. W. STUBBINGS.

Objections to the two-wattmeter method of power measurement in three-phase circuits have, from time to time, been raised, on the score that, at power factors in the neighbourhood of 0·5, one of the wattmeters will be working at an apparent power factor which is very small, when its registration will be subject to very large errors. Such large errors will evidently have a relatively small effect on the accuracy of the combination, in that the wattmeter with the low power factor will, in all but exceptional cases, register but a small fraction of the total power. In view of the importance of the matter, a brief inquiry into the effect of phase-angle error in the two wattmeters on the accuracy of the combination will, perhaps, not be found uninteresting.

The phase angle of a dynamometer wattmeter is the angle of phase displacement between the magnetic fields due to the current and potential elements of the instrument when it is supplied at unity power factor. The phase angle of an induction watt-hour meter can be taken as $90^\circ - \theta$, where θ is the angle of phase displacement between the voltage and the flux which this voltage produces. The effect of the phase angle is to cause the wattmeter to read approximately $I V \cos(\phi \pm \alpha)$ α being the phase angle, and the error so caused is $I V \sin\phi \sin\alpha$, when α is so small that $\cos\alpha$ can be taken as being equal to unity. The inaccuracy, expressed as the ratio error/true watts, is, therefore, $I V \sin\phi \sin\alpha / I V \cos\phi$, or $\tan\phi \sin\alpha$. Accordingly, at low power factors, when $\tan\phi$ is very large, considerable errors may be caused by a small phase angle, the effect of which is quite negligible at power factors of 0·9 to unity.

In the case of a balanced three-phase circuit, the two wattmeters measuring the power will give, apart from the phase-angle error—

$$I V \{\cos(\phi - 30) + \cos(\phi + 30)\}.$$

If the phase angles of the two wattmeters be each equal to α, the error so caused will be—

$$I V \{\sin(\phi - 30)\sin\alpha + \sin(\phi + 30)\sin\alpha\} = \sqrt{3}\, I V \sin\phi \sin\alpha.$$

The inaccuracy is—

$$\sqrt{3}\, I V \sin\phi \sin\alpha / \sqrt{3}\, I V \cos\phi = \tan\phi \sin\alpha.$$

The inaccuracy of the combination is, therefore, the same as that of each of the two wattmeters when used on a single-phase circuit.

If the phase angles of the two instruments are not the same, α_1 being that of the leading wattmeter and α_2 being that of the instrument in the lagging phase, the error will be—

$$I V \{\sin(\phi - 30)\sin\alpha_1 + \sin(\phi + 30)\sin\alpha_2\} = I V \{\tfrac{1}{2}\sqrt{3}\sin\phi(\sin\alpha_1 + \sin\alpha_2) + \tfrac{1}{2}\cos\phi(\sin\alpha_2 - \sin\alpha_1)\};$$

or, since $\sin\alpha_1 = \alpha_1$ approximately—

$$I V \{\sqrt{3}\sin\phi \sin\tfrac{1}{2}(\alpha_1 + \alpha_2) + \tfrac{1}{2}\cos\phi \sin(\alpha_2 - \alpha_1)\}.$$

The inaccuracy is, therefore—

$$\operatorname{Tan}\phi \sin\tfrac{1}{2}(\alpha_1 + \alpha_2) + \sin(\alpha_2 - \alpha_1)\,/2\sqrt{3}$$

This expression, indicates that the accuracy of the combination depends upon the phases in which the wattmeters are connected.

If the combination consists of a two-element three-phase integrating wattmeter, and the quadrature adjustment be made by arranging for standstill on zero power factor, it is seen that the required condition is obtained, either when α_1 and α_2 are each zero, or when $\alpha_1 + \alpha_2 = 0$, since in these circumstances, $\cos\phi = \cos 90^\circ = 0$. If $\alpha_1 = -\alpha_2$ the inaccuracy is—

$$\sin(\alpha_1 - \alpha_2)/2\sqrt{3} = \sin\alpha/\sqrt{3}.$$

This inaccuracy is constant for all power factors, except in the limiting case of zero power factor when percentage inaccuracy is meaningless. If, for instance, the meter were adjusted for standstill at zero power factor, so that $\alpha_1 = -\alpha_2 = 3^\circ$, there would be a constant percentage inaccuracy of $\sin 3^\circ/\sqrt{3}$, or 3 % approximately at all power factors.

A more general case for consideration is that of an unbalanced load. Assuming a symmetrical voltage system, and equal phase angles in the two wattmeters, the power given by the combination, apart from phase angle error, is—

$$V\{I_1\cos(\phi_1 - \alpha - 30^\circ) + I_2\cos(\phi_2 - \alpha + 30^\circ)\}$$

The error due to phase angle is—

$$V\sin\alpha\{I_1\sin(\phi_1 - 30) + I_2\sin(\phi_2 + 30^\circ)\}.$$

But $I_1\sin(\phi_1 - 30^\circ) + I_2\sin(\phi_2 + 30) = X$

is evidently the total wattless component of the apparent power in the circuit.

The inaccuracy is, therefore, given by $\tan\phi a \sin\alpha$, where ϕa is the phase angle of the three-phase circuit, as defined by the relation $\tan\phi a$ = wattless component of apparent power/actual power.

The accuracy of the combination is, therefore, equal to that of the individual wattmeters under all conditions of loading.

If the phase angles of the two wattmeters are not equal, the error introduced is—

$$V\{I_1\sin(\phi_1 - 30)\sin\alpha_1 + I_2\sin(\phi_2 + 30)\sin\alpha_2\}.$$

The inaccuracy is, therefore—

$$\{I_1\sin(\phi_1 - 30)\sin\alpha_1 + I_2\sin(\phi_2 + 30)\sin\alpha_2\} \div \{I_1\cos(\phi_1 - 30) + I_2\cos(\phi_2 + 30)\}.$$

Since I_1, I_2, ϕ_1 and ϕ_2 are all independent, this expression can only be interpreted if the particulars of the loading are known.

INDUSTRIAL LIGHTING.

Ideal Requirements (Legislative and otherwise), and Practical Solutions.

A discussion on the above subject was opened by Mr. L. Gaster at a meeting of the Illuminating Engineering Society on February 28th.

In the opening section of his address Mr. Gaster remarked that a definition of ideal factory lighting was needed. It could be broadly described as one that would enable work to proceed at night with the same ease, convenience, and safety as existed under the best daylight conditions. Experience, as summarised in the reports of the Home Office Departmental Committee on Lighting in Factories and Workshops, indicate that the following main requirements should be fulfilled: (*a*) Sufficient illumination; (*b*) constancy and uniformity of illumination over the working area; (*c*) the placing and shading of light so that no prejudicial effects are experienced from "glare"; and (*d*) the placing of lights so as to avoid inconvenient shadows on the work.

In practice the best course is, perhaps, to group together certain industries having broadly similar requirements, to study them in detail, and to see how conclusions apply in other cases. In American codes it is usual to specify a minimum working illumination, ranging from 1 to 5 ft-candles, for rough, medium, and fine work. The most scientific procedure is to experiment with different illuminations, asking workers to state when the illumination is sufficient or otherwise; such tests may be supplemented by records of output under varied lighting conditions, and recent experience in Chicago suggests that improved illumination may lead to a substantial improvement in output and diminution in spoiled work. But in any case we must consider lighting conditions *as a whole*. Sufficient illumination must be accompanied by observance of other essential requirements, such as the avoidance of glare and troublesome shadows, to get good results. Higher illumination is needed for work with darker materials, in cases (such as occur in the textile industry) where it is difficult to get the requisite illumination at the actual point where work is done, and in the lighting of cutting surfaces, sewing machines, &c., when the avoidance of inconvenient shadow plays an important part.

Mr. Gaster then proceeded to deal with legislative requirements, recalling that the Home Office Committee had already recommended a statutory provision of adequate lighting in general terms. Legislative measures require very careful consideration; one may hesitate to legislate on many matters on which recommendations may confidently be made. Any form of "code" must be such that it can readily be enforced and will prevent the abuse of industrial lighting, but will impose no hardship on the manufacturer.

The Home Office in this country has acted wisely in first recommending certain values of illumination desirable in the interests of safety and general convenience (0.1-0.4 foot-candles), apart from the illumination needed for the efficient performance of work. It was understood that much information on working illumination had been compiled. It is anticipated that values of illumination necessary for the efficient carying out of various industrial processes will ultimately be settled by conference with representatives of the industries concerned—a step that is in accordance with the wise principle of "Government by Consent."

The second report of the Home Office Committee, which was issued last year, makes general recommendations on the avoidance of flicker and troublesome shadows, and contains the following recommendation on the subject of glare:—

"Every light source (except one of low brightness*) within a distance of 100 ft. from any person shall be so shaded that no part of the filament, mantle, or flame is distinguishable, through the shade, unless it be so placed that the angle between the line from the eye to an unshaded part of the source and a horizontal plane is less than 20 deg., or in the case of any person employed at a distance of 6 ft. or less from the source not less than 30 deg."

The recommendation, while not attempting to impose ideal conditions, would doubtless remove the worst examples of glare; it can be readily complied with in various ways. Mr. Gaster presented diagrams showing how sources could be kept outside the prescribed angle, and pointed out the advantage of using reflectors such that the filament or mantle falls above the level of the edge of the reflector. (Thus a reflector such that the angle between a line from the edge of the reflector to the lowest part of the filament, and the horizontal, is not less than 30 deg. could be hung in any position in a room without conflicting with the recommendation.)

It is useful to compare our experience with that in the United States. The "codes" of industrial lighting applied in that country are based on principles similar to those accepted in England, but the requirements are more detailed. In the latest code issued by the American Illuminating Engineering Society, however, the rules are only three in number and of a simple character. They are supplemented by very complete explanatory data, and an appendix explaining the advantages of good illumination. It is indicated that the *minimum* values of illumination prescribed (1 to 5 foot-candles for working illumination) would often be advantageously exceeded in practice. The treatment of glare is very scientific, and takes into account both the intrinsic brightness and candle-power of sources.

In reviewing future work Mr. Gaster emphasised the utility of co-operation with various technical bodies concerned with industrial lighting, and paid a tribute to the work of the Industrial Fatigue Research Board, with which Mr. D. R. Wilson, a member of the Society is associated. Industrial lighting is to be dealt with by a special international technical committee appointed by the International Illumination Commission, and it is also receiving attention from the International Labour Bureau operating under the League of Nations at Geneva. It is hoped that ultimately an international code of industrial lighting may be framed.

The discussion was opened by Mr. D. R. Wilson, who, as a member of the Home Office Departmental Committee, was in a position to appreciate the need for further researches on a scientific basis, in which research associations and industrial boards should co-operate. Mr. Gaster, he said, had mentioned a case in which the cost of lighting formed only 0.3 per cent. of the cost of production. While the proportion was doubtless usually a low one, he thought that this figure would not apply to all industries, in the silk industry, for instance.

Mr. W. R. Rawlings agreed as to the importance of standardising lamps and reflectors, but pointed out the importance of careful maintenance so as to ensure that the original intentions of the designer were not falsified by the insertion of lamps of unsuitable dimensions. In dealing with values of illumination it would be an advantage if the public, who did not understand "foot-candles," could be given some general indication of the amount of illumination needed—such as the amount of light ordinarily provided on a dining room table or a ball room floor.

Mr. J. Herbert Fisher (President of the Ophthalmological Society) said that ophthalmic surgeons had only within recent years taken up the study of illumination, largely as a result of the influence of the Illuminating Engineering Society. They had, for instance, with Mr. Gaster's help, arrived at a standard of illumination for type-sheets used in sight-testing. The consideration of the values of illumination needed in different industries was a most important question, in the solution of which ophthalmic surgeons should co-operate. One point that should be considered was the effect of the sight of the operator, and the influence of age, in deciding the amount of light he needed to do his work well.

Mr. J. W. T. Walsh (National Physical Laboratory) said he attached the greatest importance to securing the help of experts in other countries in dealing with the problem.

Mr. P. J. Waldram remarked that the values of illumination given in the American codes seemed very high. There was some danger that too much importance might be attached to high illumination, irrespective of other important factors. In many offices which he had inspected illuminations under 2-foot candles occurred.

Mr. J. G. Clark remarked that there had been a great improvement in industrial lighting during recent years, but much remained to be done. He also raised several points in connection with the interpretation of the Committee's recommendation with regard to glare, which seemed to deserve further consideration. He emphasised the great importance of periodical and efficient maintenance.

Mr. L. M. Tye, Mr. S. B. Chandler, and others took part in the discussion, to which Mr. Gaster briefly replied.

*By "low brightness" is meant an intrinsic brilliance of not more than five candles per sq. in.

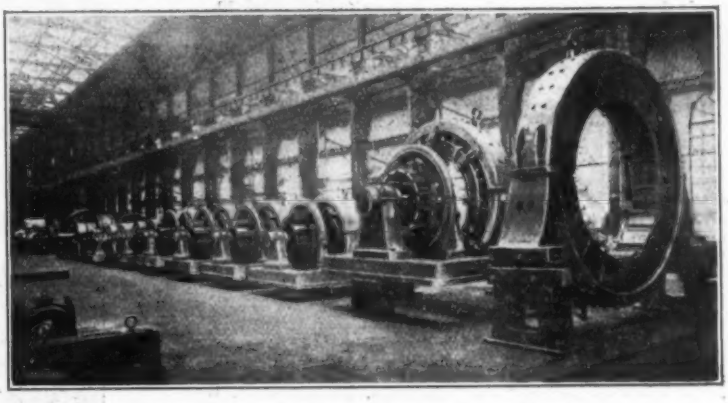
ENGLISH ELECTRIC ROTARY CONVERTERS.

The accompanying illustration shows a number of English Electric rotary converters in various stages of construction. The frame on the right-hand side belongs to a very heavy-current low-voltage machine designed to give a direct-current supply for rolling-mill work. The armature belonging to it may be seen on the extreme left. This is designed to carry about 6,000 amps., and a special double-commutator construction has been adopted.

Next to the frame of this machine are a number of parts of a 1,500-kW machine for municipal service, designed to run at 428 r.p.m., and, still proceeding to the left, there are machines of 1,100 kW, 1,000 kW, 500 kW, 250 kW, and 200 kW.

In addition to the above, four or five more machines were running on the test-bed at the time, varying in output from 1,500 kW down to 200 kW, and the modifications in design between the largest and the smallest sizes of some 15 machines dependent upon the conditions of service and the frequency of the alternating-current supply form a most interesting and attractive study.

The English Electric Co. intends to build all its rotary converters for industrial or municipal service at the Siemens Works, Stafford, which are exceptionally well laid out to deal with a wide range of machines suitable for the varying conditions of periodicity and voltage met with. Another part of the same works is devoted to the manufacture of the whole of the a.c. and d.c. switchgear necessary to control the rotary converters, while the step-down transformers for working in conjunction with the converters are manufactured by the company at its Coventry works, so that the company is in a position to furnish the entire equipment of a rotary converter sub-station from its own factories.



English Electric Rotary Converters in Various Stages of Construction.

Birmingham Inventors' Society.—On March 13th a society of inventors was formed in Birmingham with the object of assisting members with capital and legal advice. All patents would be applied for, it was stated, in the joint names of the society and the inventor, and the same arrangement would apply to the sale or licensing of such inventions.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric "Vaporiser" for Motor-cars.

An electric vaporiser (so-called) for use on automobiles (fig. 1), made by the Kase Electric Co., of Duluth, Minn. (U.S.A.), was recently described by the Canadian *Electrical News*. It consists of four metal grids in a heat-insulating case, made in the form of a gasket for insertion between the

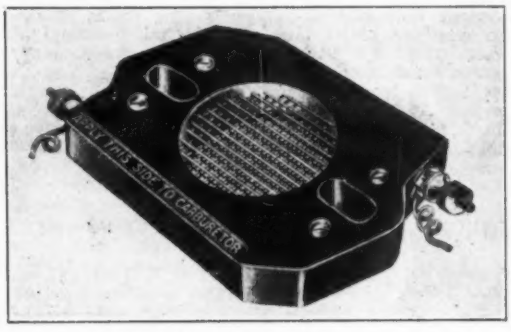


Fig. 1.—An Electric "Vaporiser."

carburetter and the intake manifold flanges. One terminal of the heater is connected to the car battery, through a switch placed in a convenient position, and the other terminal is earthed. The object of the device is to dry and warm the petrol vapour as it passes through the intake so that igniti " may taken place promptly and efficiently.

A Flexible-shaft Grinding Outfit.

The "Witton" small-power motors manufactured by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, are being applied to a multiplicity of uses. Fig. 2 shows a ½-h.p. "Witton" motor incorporated in a flexible-shaft grinding outfit. As will be seen from the illustration,

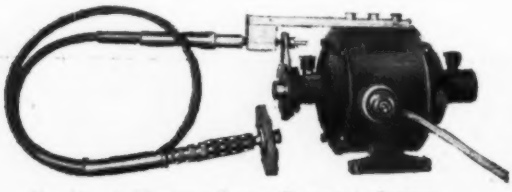


Fig. 2.—A Flexible-Shaft Grinding Outfit.

direct strain is taken off the motor shaft, and the speed increased, by means of an overhung bearing, through which the end of the 5-ft. flexible shaft passes, being driven by a small belt from the motor pulley. The grinding wheel is 4 in. in diameter, and operates at 2,000 r.p.m. The control switch is mounted on the machine.

A "Creda" Safety Device.

The absence of flame, noise, and smell which is one of the advantages of electric water-boiling appliances, is liable to cause them to be left "on" at times, inadvertently, resulting in burning out, which engenders expense and annoyance. To guard against this probability, the Credenda Conduits Co., Ltd., Whitehouse Street, Aston, Birmingham, has introduced a new protective device which ensures that the energy is only allowed to flow while the utensil to which it is applied

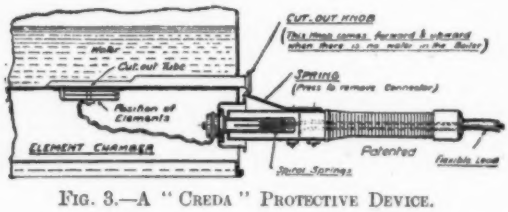


Fig. 3.—A "Creda" Protective Device.

has a certain amount of liquid in it. A sectional view of this device is given in fig. 3. A tube of special metal is fixed between the heating elements and the bottom of the utensil. From the end of this tube a small knob projects, and this is allowed to move forward and upward when the metal reaches a certain temperature. The sockets of the connector are fitted with spiral springs which are compressed by the terminals on the utensil; the connector is retained in position by a flat spring with an end which engages with the flange of the protector knob. It will thus be seen that when the knob is pushed forward and upward, the flat spring is released and the connector is pushed out by the spiral springs. Immediately the device has functioned the knob returns to its original position.

Armoured Draw-out Mining Switchgear.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, have sent us particulars of their flame-proof switch pillars for use in fiery mines. These are designed on the lines of their well-known armour-clad switchgear for sub-stations and power stations, and are admirably adapted for mining work on account of their mechanical strength, compactness, accessability, and (most important of all) the degree of safety which they afford. The switch carriage portion contains all working parts, adjustments, coil, &c., and can easily be withdrawn as a self-contained part and locked off from all contact with the busbars, leaving the plug receptacles as the only live contacts, but they are so deeply recessed as to make accidental contact impossible. As a further precaution a locking-off door is fitted in order to screen the plug receptacles, thus making the gear absolutely safe to handle. As will be seen from the illustration (fig. 4), the switches are fitted with heavy boiler-plate steel tanks, with welded joints and wide machined flanges. The busbar chambers and cable dividing boxes are filled with compound. The switch tank is filled with oil, so that there is no available space for the collection

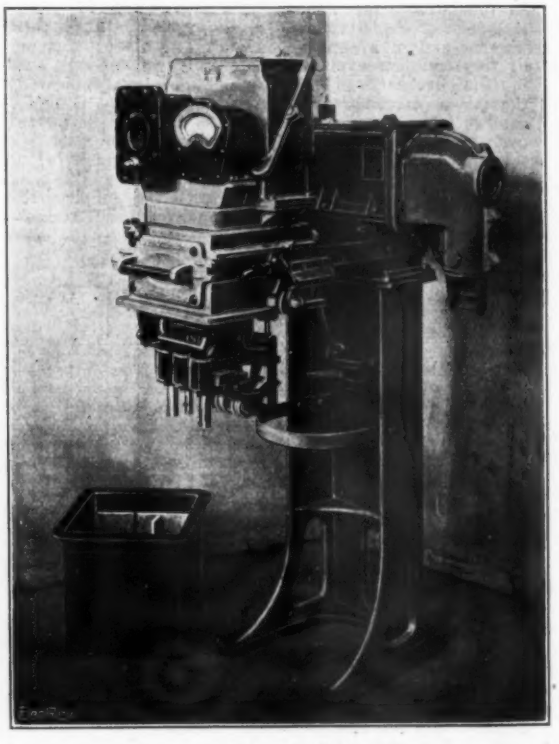


Fig. 4.—Armoured Draw-out Mining Switchgear.

of explosive gases. The switch is provided with a loose handle, and cannot be held closed against the operating tendencies of the automatic devices. The movement of the switch is exceptionally easy, and is unaffected by vibration. The "on" and "off" positions are clearly indicated. The mechanism of the switch is supported from the top casing and is accessible for adjustment immediately the switch tank is removed. The main moving contacts are of the laminated brush type; both moving and stationary contacts are fitted with renewable sparking pieces. The switches have a very quick release, but when delayed action is required a time lag attachment can be fitted. The coils and tripping mechanism are completely immersed in oil, so that the most delicate portion of the switch is effectively protected against damage and the risk of breakage reduced to a minimum. Simple mechanism is provided to prevent: (*a*) plugging the removable portion home when the main switch contacts are in the "closed" position; (*b*) closing the switch when the removable

portion is not plugged right home; (*c*) withdrawing the removable portion when the main switch contacts are closed; (*d*) removing the oil tank before the removable portion is withdrawn, thus ensuring that the conductors cannot be handled when alive; (*e*) plugging the removable portion home if the operator has forgotten to replace the oil tank; and (*f*) pulling the removable portion of the slide with a run. The meters are of a special type, with glasses reinforced by wire, and all joints have wide flanges, preventing the emission of sparks or flame.

LEGAL.

Undischarged Bankrupt Charged.

At Leeds, on March 8th, George Sauers, or Somers, was charged with obtaining electrical power and lighting equipment by false pretences, and with obtaining credit without disclosing the fact that he was an undischarged bankrupt. It was stated that Mr. Benson, electrical contractor, of Butts Court, was instructed by prisoner to fit up a shop in Headingley Lane with electric equipment, including a motor. In giving an estimate, Mr. Benson asked for references, and prisoner produced a number of post-dated cheques from a firm named Crowder, and payable to the prisoner. He also said he had an account with the National Provincial Bank of England. Mr. Benson did the work, but the cheque for £16 10s. which was paid to him was dishonoured, and it was found that prisoner had no account at the bank, that Messrs. Crowder had never paid any money to him, and that Messrs. Crowder, in fact, required some money from him. As there were stated to be other cases under investigation, and the whole matter was being investigated through the Bankruptcy Court, the prisoner was remanded, bail being allowed.

Weldics, Ltd., *v.* Quasi Arc Co., Ltd.

In the Chancery Division on March 10th, before Mr. Justice Eve, Sir Duncan Kerley, K.C., moved on behalf of Weldics, Ltd., the plaintiffs, for an injunction to restrain the defendants, the Quasi Arc Co., Ltd., from "threatening the plaintiffs, their servants, their agents or customers by circulars, advertisements, or otherwise, with legal proceedings or liabilities in respect of the sale or use of electrodes manufactured by the plaintiffs, alleging that such electrodes are an infringement of any legal rights," of which the defendants claim to be the owners or in which they claim an interest.

Counsel, after having explained the various methods in which electrodes were used in the process of electric welding, said that no claim could be made to the exclusive use of asbestos for covering. He said that the defendants, having obtained an order of the Court, were using it to frighten plaintiffs' customers, and were insisting upon doing it. He read a series of letters which had passed between the parties relating to the matter in which the plaintiffs had protested against the circular letter which defendants had issued and the publication of allegations against plaintiffs' rights. He (counsel) contended that the subject matter of the circular letter really formed part of an injunction which had been granted. It was first sent out in March, 1921, and afterwards in November, and the consequence of the threats which it contained was that the plaintiffs' business had been injured.

Mr. Gray, K.C., appearing for defendants, said that neither the defendants nor any person on their behalf had sent letters to the plaintiffs' customers stating that their electrodes infringed defendant company's patent, and the plaintiffs had therefore suffered no damage.

Mr. Justice Eve said that defendants claimed the right to send out the circulars to the users of blue asbestos—to those who made large purchases of it.

Mr. Gray denied that that was so.

Sir D. Kerley, K.C., said that in the circular it was stated that blue asbestos was used as a covering for other electrodes, and warning the users that it was an infringement of defendants' patent. Whenever they found people purchasing blue asbestos in any considerable quantity, they immediately sent them the circular with the judgment of the Court. If that were not stopped it would be very damaging to the plaintiffs' business.

Mr. Gray, for defendants, submitted that there was no cause of action in the case. The position with regard to the plaintiffs was that they first wrote to the defendants and asked if any of the goods were an infringement. Defendants said, "Let us see your samples and then we will tell you." Beyond that the plaintiffs had nothing to do with it. The plaintiffs would have to show that the circular referred to their goods, and he submitted that there was not a scrap of evidence to that effect. So far as plaintiffs were concerned, they were dismissed from any risk of action when they sent samples to defendants, and they admitted that there was no infringement of the patent.

Mr. Justice Eve asked why, if that were so, the defendants, when challenged, did not say that the circulars had no reference to the plaintiffs' electrodes. If it referred to all electrodes covered with asbestos, it must include the plaintiffs' electrodes.

Mr. Gray contended that the circular was a general one, and did not point to any patent of the plaintiffs. They only sent the circular out to warn purchasers of blue asbestos that they were the patentees for the electrodes on which blue asbestos was used.

Mr. Justice Eve: Are you prepared to have the action tried at an early date and in the meantime undertake not to issue the circular?

Mr. Gray: I am prepared not to issue that circular, but if I wish to issue any other I will give the other side notice of it.

Mr. Justice Eve said that in that case he would let the motion stand over until the trial of the action. In the meantime there would have to be mutual discovery, and no circulars would be issued by the defendants without giving plaintiffs 48 hours' notice.

The motion accordingly stands over upon these terms, with liberty to apply in the event of non-compliance.

Charge of Lamp Stealing.

The Times states that at the Mansion House, on March 9th, James Young was remanded on a charge of stealing 3,100 electric lamps, of the value of nearly £500, belonging to the B.T.T. Electric Lamp and Accessories Co.

Illegal Connections to Mains.

At Ystrad Police Court recently, James Skibbo, Pentre, and Henry B. Evans, High Street, Treorchy, were summoned at the instance of the Rhondda U.D.C. for connecting to the Council's electrical system at the former's premises without permission, to obtain electricity.

Skibbo was ordered to pay costs and Evans was fined £5.

Wireless Patent Claims.

On Monday last the Royal Commission on Awards to Inventors continued the hearing of the claims made by the Lodge Muirhead Syndicate and the Marconi Wireless Telegraph Co., alleging Admiralty infringement of patents. According to the *Financial Times*, when the general manager of the Lodge Muirhead Syndicate resumed his evidence a retrospective survey of negotiations with the Admiralty over a number of years was made, and it was recalled by Sir Arthur Colefax, K.C. (for the Crown) that in the year 1903 an agreement was arrived at between the Admiralty and the Marconi Wireless Telegraph Co. in consideration of permission to make use of certain inventions for the payment of £20,000 down and £5,000 a year for eleven years. This represented a total cash payment of £75,000.

During a discussion respecting the accuracy of documents interchanged, and in relation to one which the Admiralty had prepared, Mr. Hunter Gray, K.C. (for the Marconi Co.) said it was necessary to have properly authenticated accounts to find out where they were. The Marconi Co. was fully justified in wondering whether all the various installations which were made for the Government had been included in the lists submitted by the Admiralty. His contention was that the basis of an award ought to be pounds per kW.

Mr. J. St. Vincent Pletts, a consulting engineer and patent agent, stated that with regard to the royalties £100 per kW was the minimum amount which the Admiralty had ever paid.

The case for the Crown was opened by the Attorney-General, who criticised the basic figures upon which the claim had been framed.

The Commission adjourned until next Monday.

Hamilton *v.* Marconi's Wireless Telegraph Co., Ltd.

In this case the plaintiff appealed to the Court of Appeal, consisting of Lords Justices Bankes, Warrington, and Scrutton, on Monday and Tuesday, against an order of the Lord Chief Justice on February 24th that all proceedings in the action be stayed, and that Mr. Hamilton should pay the defendants' taxed costs.

Mr. Hamilton, who appeared in person in support of his appeal, said the Lord Chief Justice had refused to allow the action to be tried in his Court before the jury were sworn.

At the conclusion of the argument, their Lordships held that the order of the Lord Chief Justice was too wide. They directed that the proceedings in the present action should be stayed for one month to enable the plaintiff to start a fresh action in the Chancery Division for relief from his undertaking and for rescission of the agreement, and discharged the order of the Lord Chief Justice as to the costs, making a special order as to the costs in certain eventualities.

An Exhibition at Hanley.—The Potteries Branch of the Electrical Contractors' Association has taken a large space at an Ideal Homes Exhibition to be held at Hanley, Stoke-on-Trent, from May 4th to 20th next. The secretary, Mr. A. Gould, c/o Messrs. Barnett & Sons, 34, Church Street, Stoke-on-Trent, will be pleased to hear from firms willing to co-operate.

REVIEWS.

Fuel and Refractory Materials. By A. Humboldt Sexton, F.I.C., F.C.S. New Edition. Revised by W. B. Davidson, D.Sc., Ph.D., &c. Pp. 382; figs. 111. Blackie and Son, Glasgow and Bombay, 1921. Price 12s. 6d. net.

Books on fuel are plentiful as wasps in summer, but that important accessory of furnace work and combustion—refractory material—has been comparatively left alone.

The reviser has not introduced recent new views on coal, feeling that these are too new to have found a firm base, nor does he bring in the later theories on coking, a subject which, from the little known to our reviewer, is probably awaiting a pretty big book all to itself.

The first part of the book deals with combustion and the chemicophysical properties of fuel on very much the usual lines.

We note that the author uses Thomson's figures in his thermo-chemical notes rather than those of Berthelot. The two great authorities named are in such close agreement on the elementary figures that it almost seems to be time to standardise the thermo-chemical figures for hydrogen, carbon and their compounds, so that future work may be simplified and comparable. The exact determination of calorific figures is not possible. Why not let us have a standard round number? The total available coal in the earth is given as equal to 6,000 years of the present rate of use. Lignite is presumably included in that total, and is only known at Bovey Tracey, in Devonshire, so far as Britain is concerned, but let us add from long-standing knowledge of this deposit that within a comparatively small depth there is one bed 60 ft. in thickness, and there may be much below this. The depth of this oligocene clay has, we believe, not yet been proved.

In Chapter IV prepared fuels are dealt with, such as coke and charcoal. Coalite is described, but we find no reference to annealed gas coke, which certainly deserves full notice as a domestic fuel easily ignited and smokeless.

Modern coking processes are illustrated. Briquetting also is treated of, and coal washing. The beauties of washed coal have not, however, appealed to those who send coal at great cost to citizens with an utter disregard of its enormous content of dirt, slate, clay and stone. Whither goes all the washed coal?

From this book's figures we gather that the United States produces 67 per cent. of the total oil of the world. Yet these same United States fiercely grudge us the fraction of a per cent. we have, according to them, laid violent hands upon in Mesopotamia. Really, Uncle Sam is very grasping. The chapters on liquid fuel and gaseous fuels are good.

Smoke prevention is dismissed in a dozen lines with the advice to use gaseous fuel. Only when we reach page 268 do we begin to get into touch with refractory materials and temperature. A table is given of Seger cone softening points, cone numbers and temperatures.

The Fery pyrometer is described. But only at page 329 do we find the Chapter XV devoted to refractory materials, bricks, and crucibles, and there are but forty pages of it, but what there is, is well put, and probably includes most of what the engineer usually requires to know.

The book can heartily be commended.

High-frequency Apparatus. By T. S. Curtis. Pp. 269; figs. 150. London: Page & Co. Price 9s. net.

This book of 266 small pages is described as a treatise for the use of electrical engineers, students, &c. When the author remarks in his preface "Theory has been ignored chiefly because it would serve to merely confuse the non-technical reader," the value of this "treatise" to the electrical engineer can be appreciated. In actual fact it belongs to the class of book which, upon no fundamental grounds, is written for the dabbler in electricity. The serious student of electricity would be better advised to leave such books, which lead nowhere, severely alone, and to purchase a good book on "Electricity and Magnetism," and commence the real study of the subject. As a pot-pourri of spectacular electricity, this book comprises information on "what the alternating current is," construction of transformers, spark gaps and condensers suitable for wireless telegraphy, several types of apparatus useful for physicians, hot wire ammeters (five pages), notes for beginners in electro-therapeutics, several chapters on plant culture, and electrical apparatus for stage displays. Three chapters are devoted to the construction of apparatus for electro-therapeutical uses, and, assuming the physician has the necessary workshop experience to benefit by the scanty information given, what the author does not appear to realise is that any physician having a practice sufficient to warrant the use of electrical treatment would find it, as a mere financial proposition, of greater value to buy more reliable apparatus made by skilled mechanics rather than to waste his own valuable time in making trumpery amateur apparatus at the expense of his practice. A further chapter, "intended as its name implies for the physician who feels a growing interest in the possibilities of electro-therapeutics, but who knows very little on the subject." borders on impudence. The author's remarks on arterio-sclerosis make it evident that his knowledge of the morbid histology of this disease is nil, and the physician who is likely to derive benefit from the perusal of this chapter would be better advised to leave electro-medical work severely alone unless his methods are based on the author's remark, "The entire success of the electro-therapeutic treatment may be said to rest in the practitioner first of all inspiring confidence in his patient," in which case his bedside manner is likely to be sufficient without further training by the author.

The present reviewer is unable to comment from practical knowledge on the chapters on plant culture, except from the general scheme of the book. In the chapters on "scientific" demonstrations in electricity of the music-hall stage type the author would appear to be more at home, but there exists a very old book by Prof. Pepper which is perhaps far more extensive and useful.—B. Leggett.

Radiographic Technique. By T. Thorne Baker, A.M.I.E.E. Pp. xii+196; figs. 62. London: Constable & Co. Price 15s. net.

This book, by a well-known worker in X-ray technology, is likely to be of extreme value to all engaged in such work. As the author states in his first chapter, X-ray technology is a threefold science requiring a knowledge of photography and electricity, as well as medicine. The author, with the exception of a first general chapter, largely confines himself to the photographic aspects, which, as he states, are usually omitted in general books on X-rays, but which in practice may make all the difference to successful operation, allowing one man, with photographic knowledge, to obtain with inferior apparatus better results than another without this knowledge, but possessing a powerful installation. In view of this purposeful limitation in the book, a better title might possibly be "Radiographic Photographic Technique," to avoid this book being ordered under a misconception that it deals with general radiography.

The whole book is essentially practical, but where necessary theoretical matter, such as chemical reactions, has not been omitted, and it is evident that any omission is not due to lack of the necessary knowledge on the part of the author. The first chapter, as already mentioned, deals with X-ray work in general, and is essentially practical even to methods of cleaning the mercury of interrupters. The second chapter deals with the photographic plate, sufficient theory being introduced and the choice of plates on various grounds being discussed. The X-ray tube is then described in detail, and the use of rectifying valves to prevent the inverse current. A chapter on storage and handling of plates contains many useful formulæ for solutions. The next chapter deals with the purposes and advantages of the use of intensifier screens, and the advantage is vividly shown by a contrast photograph (fig. 33) of a booted foot, one half of which is intensified and one half not intensified. This is followed by a chapter on fluorescent screens which, besides giving a thorough scientific treatment, gives such details as the danger to the screen usefulness due to its being put near heated objects as radiators. A short chapter is devoted to stereoscopy, *i.e.*, the exact location of foreign objects, before operation, by means of X-rays.

Further chapters deal with the dark room and its equipment (a suitable equipment being given in detail), intensification, and reduction of under-exposed or over-exposed and undeveloped plates, and of printing processes.

Chapter X on the more recent industrial applications of X-rays for the examination of castings, faulty welds, aeroplane timber, &c., makes it evident that the manufacturing engineer may soon require a knowledge of X-ray technique if such tests become a routine method of examination, and in view of this, the matter on the protection of the operator will become of still more value.

The final chapter, on chemical analysis by X-rays, gives recent work by Debye & Schewer, Hull, the Braggs, and others, and so stimulates the reader's interest that it is with great regret he finds the author has necessarily to limit his space on such a subject to a few pages. The appendices, like the rest of the book, are essentially practical and useful, giving it an important place as a reference book on the shelves of all engaged in X-ray technology.—B. Leggett.

Electrically Cultivated Bacteria.—A process has been invented for the production of such vaccines as typhoid and cholera on an economical scale, says the *Daily Mail*.

Bacteria of the particular disease are grown in bouillon, which is treated by passing through it an electric current at between 20 and 30 volts for two hours. The bacteria are not killed by this treatment, but are rendered quite harmless, and in this state they can be cultivated on a large scale, the new cultures being still harmless, although if subcultivated in the ordinary way they usually regain their virulence. These cultures can be mixed with a saline solution and administered by vaccination in the usual way.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Jubilee Conference, 1922.

(*Continued from page* 353.)

The reminiscences of Dr. G. Kapp covered the period 1885-95. He recalled a visit early in the 'eighties to see at Paddington Station the late Mr. Gordon's alternator used for supplying electricity for lighting. The machine was direct-coupled to a low-speed piston engine and appeared to them a gigantic machine. About that period he inspected a small lighting station in London, where two belt-driven Westinghouse machines were installed; they had rotating armatures and in general build resembled d.c. multipolar machines. There was no provision for parallel running, but either machine could be put on to the external circuit and when changing over there was a momentary interruption of supply. Those two sets of plant were the first practical examples of a.c. supply in this country.

In his own alternator Dr. Kapp aimed at making nearly the whole of the armature winding active, and that led to a disk armature with a coiled-band iron core. That machine was not taken up by any English maker, but the Oerlikon Co. built them for some years and some were of fairly large size; for instance, the equipment of the Zurich central station worked by the water power of the Limmat. Eventually all those early machines were superseded by the type now adopted by all makers—namely, a revolving-field and fixed-armature type with the winding housed in slots. It took 15 years to arrive at such a simple and straightforward design, and he could not help speculating whether they were not at present still groping in other matters along devious paths which would ultimately lead to some simple solution.

In transformer design something similar had to be gone through. Some wanted to reduce hysteretic loss, others to save iron, others to save copper, others to reduce inductive drop, and so on, but in each case they had to pay for the attainment of their desire in some unforeseen way. In his own case he wanted to reduce labour and utilise every scrap of iron stamped out of the sheet by using the rectangle stamped out of the horse shoe as the second yoke. The transformer proved a failure, because even if tightly screwed up it acted as a trumpet. Eventually they saw what things were of real importance; the highly mathematical investigation as to the best shape and proportions of transformers undertaken by many theorists had not proved of much practical value. Makers built as it suited the workshop and, although there were considerable differences in the details of design, all transformers made by respectable firms were about equally good.

By the time the whole profession had become reconciled to single-phase a.c. plant, American, German, Swiss and Italian makers had taken up three-phase working, but in this country there was some reluctance to adopt the new development. Engineers had to order their three-phase plant at first from abroad, but soon English makers recognised its advantages and now English plant was quite as good as, and perhaps a little more robust than Continental plant.

Sir Alexander B. W. Kennedy, F.R.S., said that when he forsook marine engineering for "this dreadful pastime of yours," there was no man in London or anywhere else who helped them on more than Colonel Crompton did. Whatever he found out, whatever good work he heard of, he put at the service of the rest of them. They were all very much indebted to him at that time and since. Sir Alexander then spoke of how electricity started in Westminster when he had to do with the starting of it there. The present Westminster undertaking started as a small shanty in Dacre Street and another in Chapel Street, and some d.c. sets in the stoneyard of the Houses of Parliament, which were used specially to supply the latter. He was there when the supply was opened in February, 1890.

In the first quarter of 1891 they had a total income of 2,600 odd pounds. They were, of course, fighting Ferranti at the same time. At Millbank Street or Stoneyard they were using 7¾ lb. of coal per kWh, which was less than one-half the best high-pressure result.

During those years there was a great question whether one could parallel two stations. He stood by one of the machines and telephoned through from one station to the other. The stations used were those at Dacre Street and Stoneyard and the date of the experiment was February, 1891. They solemnly connected the two stations together—and nothing happened. They started to turn the old two-wire system into the three-wire system in Westminster in September, 1891, and finished in December, 1891. Their early machines were very large: they were of 112 kilowatts and they cost from £1,700 to £2,300. A short time afterwards he wanted tenders for machines of double that size and had very great difficulty in getting them; only two makers in this country were prepared to tender for 250-kilowatt dynamos.

Sir Oliver Lodge recalled that his house in Birmingham was lighted by an amateur, Allbright, who had been a pupil of Crompton's, and it was the first house in Birmingham that was lighted by electricity. Although they could have got on the mains they continued using their 40-volt system of accumulators and the Crompton dynamo, &c., until he left, about two years ago. The wiring, however, would have shocked any experts; it did very well for 40 volts. He remembered when there was no "ohm," and had spoken of 70 feet of ordinary bell wire—that was the kind of standard of resistance they used to use. When they wanted to have the electric arc light at University College they had to install 40 Grove cells. He remembered the ampere coming in, and a workman speaking of it as a "hamper of electricity," and also the introduction of the term "dynamo" at the British Association, by Lord Kelvin, when reading a paper on the efficiency of what they then called a dynamo-electric machine.

He, with Fitzgerald, saw the first electric railway—Lord Kelvin was there too—which ran between Portrush and Bushmills. The Siemens firm had rigged it up, and the electrical engineer was Edward Hopkinson, recently deceased; it was worked by water power from the Bushmills waterfall. The electrified rail was about one foot off the ground on little posts running by the side of the rail, and the railway ran on the side of the road. It was run at 500 volts, and they killed a cow. Lord Kelvin, however, could not feel it at all, and gravely placing his hand on the rail, after a pause, he remarked "I think I do feel something."

He was scientific adviser to the E.P.S. for a time, and there they had the first electric tramcar. It had storage batteries under the seats. The first day it was a failure because it ran out of the yard and refused to take the bend into the road. Sir William Preece spoke of self-induction publicly as a bugbear and was very much annoyed with Mr. Oliver Heaviside for emphasising the matter of self-induction in cables. The work of Mr. Heaviside had perhaps not received quite its due share of recognition. Lord Kelvin gave the theory of cables, and made the first cables possible; at any rate, he made them much more satisfactory than they otherwise would have been by his theory which took into account capacity and resistance. He did not attempt to take self-induction into account. Mr. Heaviside did, and showed that whereas resistance and capacity together were a bugbear and distorted the signals, the effect of self-inductance would be just the opposite. Loaded cables were now used for telephonic purposes, and Sir Oliver believed a great deal more could be done by self-induction in cables. Experiments had been going on for a long time on that subject, and the speed might yet be considerably increased.

(*To be continued.*)

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

The thirteenth annual report of the Hydro-Electric Power Commission of Ontario covers the year ended October 31st, 1920, and has just come to hand. Sir Adam Beck, the chairman, states that 1920 was again a period of re-adjustment after the passing of war conditions. In some parts whole industries were closed down until a fall occurred in the cost of labour and materials. This was most marked in the Eugenia and Severn areas, where the load, and consequently the revenue, was considerably reduced. The Niagara system was not so seriously affected owing to the fact that new industries arose to take the place of those that had ceased to take power. The growth of demand was such that at the end of the year there was a shortage of power. This was also due in part to the expiration of a contract for a supply of a block of power assumed by the Commission at the time of purchase of the assets of the Ontario Power Co. Owing to the abnormal increase in the cost of labour and materials, it was necessary at the beginning of the year to increase the rates charged to a number of the smaller municipalities on this system, but fortunately the increase in the business done by these municipalities resulted in an increase of revenue to them and in most cases a profit was realised. At the beginning of the year, the Commission fixed a schedule of rates to cover the estimated cost of service to all municipalities. The total revenue amounted to $3,946,133, but after meeting working and interest charges there was a deficit of $147,464, which is considered satisfactory in the circumstances which prevailed.

The operation of the Ontario Power Company's 150,000-kW plant was not marked by any unusual occurrences and no new construction of importance was carried out. The report gives detailed reasons for the drop of head and loss of power due to ice from Lake Erie, which descends in small pieces and upon being stopped by the diverters freezes into a solid block and fills the water openings. Dynamite is used to clear these stoppages. The gate valves on several of the sets have been rebuilt and provided with rising stem operating mechanisms, which are more efficient than the old type. Details are given of numerous other improvements which have been carried out to this plant, and it is stated that 1,026 million units were generated here during the year. The Niagara System, during the period of shortage, took the supply of one of the Canadian-Niagara Co.'s 9,000-h.p. sets, but the increase of demand soon absorbed this extra power, and the problem remained as serious as before. Another factor which contributed to the shortage was the expiration of a contract

with the Toronto Power Co., which deprived the system of 13,000 h.p. The report deals with the progress of the Queenston-Chippawa Development (Elec. Rev., October 8th, 1920, p. 477), which has now been opened. The Severn System's Big Chute plant was kept loaded, but the supplies taken previously from the Eugenia and Wasdell's Systems were discontinued. The Wasdell's System was not seriously affected by industrial depression as the area is principally agricultural, and service was given to many additional farms. One large industry was added as a power consumer increasing the total amount of power transmitted over the system by about 75 per cent. The power supply of the St. Lawrence System was ample. The Muskoka System was fully occupied during most of the year. Satisfactory operation of the Central Ontario System is reported. The principal feature of the year's working was the addition of the Healy Falls—Peterboro line to the system. This line is 28 miles long, with power supply of the St. Lawrence System was ample, and during March and April a block of 475 h.p. was supplied to the Toronto Paper Co., whose generating plant was temporarily closed. The plant of the Muskoka System was fully occupied during most of the year, although there was a slight falling off towards the end. Satisfactory operation of the Central Ontario System is reported. The principal feature of the year's working was the addition of the Healy Falls—Peterboro line to the system. This line is 28 miles long, with steel-reinforced aluminium conductors. It provides an additional source of power to a number of municipalities, and the telephone lines it contains are of considerable assistance in load-dispatching. The re-insulation of the 44,000-V lines was almost completed during the year. A shortage of power was caused for about six weeks by the low stream flow of the Trent River, but assistance was secured from several external sources. The addition of the new generating station, with an output of 1,575 kVA at High Falls, on the Mississippi River, enabled the Rideau System to give a full supply to the municipalities it serves. Here again difficulty was experienced from insufficient stream flow on the Rideau River, and the opening of the High Falls station was opportune. In the Nipissing System, although the load was higher, it was not found necessary to use the steam stand-by plant, which has been installed for tiding over low-stream periods. The Thunder Bay System operated satisfactorily, but it was found necessary to increase the power held in reserve from the Kaministiquia Power Co. from 6,000 to 7,000 h.p. The Ottawa and Hull Power & Manufacturing Co., which supplies power to the Ottawa System, by arrangement with the Commission, put a new station into operation during the year, and the whole of the power for Ottawa is now supplied by this plant.

The "Consolidated Operating Reports" of the systems show that earnings amounted to $9,707,901, as compared with $7,827,055 in the previous year. Expenses totalled $8,094,056 ($6,531,482), and depreciation charges $902,029 ($814,219), leaving a surplus of $711,816 ($481,354).

PARLIAMENTARY NOTES.

Second Readings.—In the House of Lords on March 9th the Black Country Tramways and Light Railways Bill and the Yorkshire Electric Power Bill were read a second time. On the 8th inst. the second reading of the following took place:—North Metropolitan Electric Power Supply Bill; South Wales Electrical Power Distribution Co. Bill; and Ayr Burgh (Electricity) Bill.

The L.C.C. Railless Traction Proposals.—Before the Court of Referees at the House of Commons last week, the Wandsworth Borough Council appeared to oppose the Bill promoted by the London County Council to introduce railless vehicles at Lewisham. The Council opposed on the ground that it was injuriously affected. Trolley vehicles were something new in street traction, and the Wandsworth authority was afraid that the proposal with regard to Lewisham would ultimately extend to the whole of London. The Council asked to be allowed to state its view now and so protect the interests of the district. Mr. Hope (Chairman of Committees), who presided, said that the Court was not satisfied that a *primâ facie* case had been made out, and the application would not be allowed.

Electric Lamps in Mines.—In the House of Commons on Monday Major Kelley asked the Secretary for Mines whether he proposed to make any new regulations governing the use of electric or other safety lamps in mines.

Mr. Bridgeman replied that no fresh regulations governing the use underground of safety lamps were contemplated at the moment. He was awaiting recommendations in the matter from the Miners' Lamps Committee. As regarded danger from choke damp, he was advised that flame safety lamps or open lights (where used) gave sufficient warning to enable the miner to withdraw in safety. The electric safety lamp, however, could give no warning of the presence of inflammable or noxious gases, and the question what steps should be taken to provide safeguards in the general use of electric lamps by the workmen in a mine was now under consideration by the Miners' Lamps Committee.

BUSINESS NOTES.

Bankruptcy Proceedings.—H. J. Pugh & Co. (trading as Herbert John Pugh), electrical engineers, 38, Broadway Parade, Crouch End.—This debtor petitioned the London Bankruptcy Court on December 31st, 1921, with liabilities £470, against assets, "bad debts, £24." He attended last week before Mr. Registrar Mellor at the London Bankruptcy Court, and stated that he commenced business on his own account in May, 1914, with £10 capital, and traded until April, 1921, when an execution was levied by a creditor. Witness then sold the contents of the premises for about £20 to his mother, who had since carried on the business and employed him as manager. In February, 1921, witness opened a branch at 16, Fore Street, Edmonton, but it was not a success, and was only in existence for a month or two. He attributed his failure to bad trade and the stoppage of his business during the execution of necessary repairs to the premises. The examination was concluded.

Arthur Courtenay Ince (trading as the Newcastle Electrical Engineering Co.), 21, Fenkle Street, Newcastle-on-Tyne, electrical contractor.—The adjourned public examination of this debtor was held on March 9th at the County Court, Westgate Road, Newcastle-on-Tyne. Debtor stated that he was born in Barbados, West Indies, and came to England in July, 1915, to enlist. He was in the Army until November, 1919, and then had between £500 and £600. He commenced the Newcastle Electrical Engineering Co. in October, 1920, with another man. In May, 1921, this man left the business, and on August 16th, 1921, debtor was joined by another man. At that time the business was in difficulties. The name was changed to the Tyne Electrical Industries, and debtor took over responsibility for the debts of the old firm. Debtor attributed his failure to bad trade and losses in trading. He stated further that he had very little experience of business in this country and had to depend upon others. The examination was adjourned to be closed.

Frederick Charles Goss, 64, Gloucester Road, Bishopston, Bristol, electrical engineer.—The receiving order in this matter was made on February 28th on debtor's own petition. The statement of affairs shows liabilities of £1,291, while the net assets are estimated at £269, or a deficiency of £1,022. Debtor attributes his failure to the slump in trade, depreciation in value of stock, expenses in connection with agency for automatic lighting plant, and expenses in connection with the illness of his wife. It appears that in May, 1919, he commenced business as an electrical engineer in partnership with another. The partnership capital, amounting to £50, was provided by debtor. When commencing, the partners had no business premises, but traded from their private addresses. In October, 1919, the partnership was dissolved, debtor taking over the assets and liabilities. Subsequently debtor traded on his own account, and for the first two years the business was fairly successful, but during the last year, by reason of the slump in trade and falling prices, he traded at a loss. On February 8th a meeting of creditors was held, when it was resolved that efforts should be made to realise sufficient from the assets to provide a composition of 4s. in the £, but as the creditors were not unanimous, the petition was filed. Debtor became aware of his position in August last.

G. M. Hallett, electrical engineer, 7, King Street, Frome.—Receiving order made March 7th on debtor's own petition. First meeting, March 22nd, at the Official Receiver's Offices, Bristol; public examination, March 28th.

J. Owen (J. Owen & Sons), electrical engineer, 186, Westcombe Hill, and 3, The Grove, Greenwich.—Last day for proofs for dividend, April 3rd. Trustee: Official Receiver, 29, Russell Square, W.C.1.

W. A. Davis, electrical engineer, late of 3, Coronation Street, Leeds.—Last day for proofs for dividend, March 29th. Trustee: Mr. H. C. Bowling, Official Receiver, 24, Bond Street, Leeds.

A. Kershaw and C. H. Wood (Kershaw & Wood), electrical engineers and merchants, 9, Bradford Road, Dewsbury.—Application for discharge to be heard at the County Court House, Dewsbury, April 5th.

M. T. B. Gordon (T. Gordon), electrical and general merchant, late of 20, Western Broadway, Hammersmith, W.—Trustee: Mr. D. Williams, Official Receiver, Carey Street, W.C., released February 15th.

J. Harrison (Harrison & Son), electrical engineer, 93, Princes Street, London Road, Southend-on-Sea.—Trustee: Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C.1, released February 24th.

G. H. Gee, electrician, 10, Front Street, Annfield Plain, Durham.—Trustee: Mr. C. Woollett, Official Receiver, 4, Northumberland Street, Newcastle-on-Tyne, released February 24th.

T. Rawsthorne, electrical engineer, 67b, Paradise Street, West Bromwich.—Last day for proofs for dividend, March 25th. Trustee: Mr. E. E. Deane, Official Receiver, 101, Corporation Street, Birmingham.

V. B. Worthington, electrical and mechanical engineer, Ellesmere Yard, Walkden.—First and final dividend of 5½d. in the £ payable March 20th, at the Official Receiver's offices, Byrom Street, Manchester.

M. Watkinson, H. Watkinson, A. Watkinson (Watt and Co.), electrical and mechanical engineers, 22 & 24, Palmer Road, Sheffield.—First and final dividend of 6s. 2d. in the £, payable March 20th, at Messrs. Parkin & Co., 36, Bank Street, Sheffield.

A. T. Williams and W. J. Bevan (Electrical and General Engineering Co.), electrical engineers, 49, Commercial Street, Aberdare.—First meeting, March 22nd, at 34, Park Place, Cardiff; public examination, April 21st.

Company Liquidations.—Neale & Freund, Ltd.—Winding up voluntarily. Liquidator: Mr. E. G. Evans, 3, London Wall Buildings, E.C. Meeting of creditors, March 20th. Particulars of claims to the liquidator by March 18th.

The Durolite Manufacturing Co., Ltd., Hardinge Lane, Penge.—Pursuant to Section 188 of the Companies (Consolidation) Act, a meeting of the creditors in this matter was held on the 10th inst. at the offices of Mr. H. C. Merrett, 41, Finsbury Square, E.C. The liquidator, who presided, said that the liabilities to unsecured creditors amounted to £2,774, while there were partly secured creditors for £891, the security held being valued at £25. The assets consisted of cash in hand £17, furniture £135, and there were 3,000 ordinary shares in a company called Clydo, Ltd., but it was uncertain what the shares would realise, and the liquidator said that it would be safe to assume, for the time being, that the assets were somewhere between £300 and £400. It was said that the Clydo Co. had been run in conjunction with the Durolite Co., and the patents of the Clydo machines, which consisted of an illuminated sign, were believed to be of very considerable value. In the result it was decided that the liquidation should be left in the hands of Mr. Merrett, with a committee of inspection.

Campion, Ball & Co., Ltd.—Winding up voluntarily. Liquidator: Mr. J. Frith, 14, St. James' Street, Sheffield. Meeting of creditors, March 23rd. Particulars of claims to the liquidator by April 20th.

British Switchgear, Ltd.—Meeting of creditors, March 28th at Australia House, Strand, W.C. Claims to the liquidator, Mr. T. D. Marshall, 10, Bush Lane, Cannon Street, E.C., by March 28th.

C. Portass & Son, Ltd.—Meeting, April 20th, at 155, Norfolk Street, Sheffield, to hear an account of the winding up from the liquidators, Messrs. J. S. Hancock and C. Turner.

Sequestration.—J. Walker (carrying on business at various addresses from time to time as J. Walker, J. Walker & Co., Walker & Co., and Walker & Nicholson), manufacturer of medical electrical appliances, 9, Thistle Street, Glasgow.—Estates sequestrated by the Sheriff of Lanarkshire at Glasgow on March 7th. Meeting to elect trustee and commissioners, March 20th at the Faculty Hall, Glasgow.

Dissolutions of Partnership.—J. C. Arnall & Co., electrical and mechanical engineers, 1, Thomas Street, Smethwick.—Mr. A. N. Gosling and Mr. J. C. Arnall have dissolved partnership.

Provincial Lighting & Engineering Co., Engineers, 9, Derby Road, Weaste, Lancaster.—Messrs. I. Faulkner and C. T. Joyce have dissolved partnership. Mr. Faulkner will attend to debts.

Trade Announcements.—Messrs. Bailey & Thorpe have commenced business as electrical and mechanical engineers, &c., at Prince's Dock Chambers, Prince's Dock, Hull, and they wish to receive catalogues.

The Spearing Boiler Co., Ltd., and Messrs. Tinkers, Ltd., the well-known Lancashire boiler makers, of Daisyfield Boiler Works, Hyde, near Manchester, have come to an arrangement under which the Spearing Co. acquires the controlling interest in Messrs. Tinkers. The Spearing water-tube boiler will in future be made at the works of Messrs. Tinkers, where large extensions, to cope with the rapidly-growing demand for the Spearing boiler, are to be carried out. Mr. Spearing will join the board of Tinkers, Ltd., as chairman, and Mr. Frank Tinker will continue to act as managing director.

Messrs. W. E. Hughes & Co., of 50 & 51, Lime Street, London, E.C.3, have been appointed the sole agents for Great Britain of the Société Suisse de Clématéite at Vallorbe (Switzerland), makers of "Clématéite" insulating material.

In connection with the liquidation of the Wilson-Wolf Engineering Co., Ltd., under the reconstruction scheme, Messrs. Pooley & Austin, of 34, Broadway, Westminster, S.W., have been re-appointed the sole London agents for the new firm, and will continue to supply fractional horse-power motors from stock in London, or direct from the works as hitherto. It is hoped to have all sizes for both a.c. and d.c., from 1/30 up to ¼ h.p., in production within the next few months.

Catalogues and Lists.—Messrs. W. E. Hughes & Co., 50 and 51, Lime Street, E.C.3.—A catalogue illustrating a number of insulating-material manufactures produced by the Swiss firm La Société Suisse de Clématéite.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—List No. 1,322, giving reduced prices of cables and wires.

Messrs. Johnson & Phillips, Ltd., Charlton, S.E.7.—"Transformer Abstracts" No. 7. This issue explains why current rushes take place upon switching-in a transformer on no load.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.1.—Pamphlet No. 130 F., giving a description of the "Stannos" concentric wiring system and photographic views of several installations.

Mr. J. B. Rudkin, 212a, Shaftesbury Avenue, W.C.2.—A well-illustrated list giving full particulars and dimensions of switches and switch-fuses of various patterns made by the Sprecher & Schuh Co., of Aarau, Switzerland.

Messrs. L. G. Hawkins & Co., 116, Charing Cross, Road, W.C.2.—A small folder dealing with "Vio Ray" high-frequency outfits. Priced and illustrated.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—An illustrated stock list (in French) of a.c. motors and d.c. motors and dynamos.

Messrs. Strode & Co., Ltd., 48, Osnaburgh Street, N.W.1.—An illustrated booklet presenting a number of examples of metal-work, including shop fronts, doors, interior decoration, &c., carried out by the firm.

Imperial Electrical Trading Co., 106, Charing Cross Road, W.C.2.—An illustrated and priced leaflet of "silvered pyramidal" shades and reflectors.

Our Foreign Trade.—February Figures.—The following were the values of imports and exports of electrical goods and machinery during February 1922:—

	Feb. 1922. £	Inc. or dec. £	2 Months 1922. Inc. or dec. £
Imports—			
Electrical goods and apparatus	89,442	– 127,793	– 258,726
Machinery	637,524	– 619,338	–1,656,557
Exports—			
Electrical goods and apparatus	608,763	– 515,038	–1,007,727
Machinery	4,636,529	–1,761,400	–4,021,840
Re-exports—		...	
Electrical goods and apparatus	21,349	– 8,693	– 27,026
Machinery	95,416	+ 713	– 64,261

A German's Call for Help.—Surely no friends of British electrical manufacturing will be likely to yield before the advances that are being made by certain would-be German electrical exporters who want our buyers to lend them aid in securing facilities for German travellers to more easily enter the British market. A correspondent has sent us a copy of circulars received from a firm in Berlin stating that Mr. So and So will soon be coming across to call personally in order to show him samples of latest models of magneto electric lamps. The following quotations from the circular will entertain our readers: "In order to overcome the existing difficulties in procuring the necessary passport and travelling permit, we shall consider it a great favour if you will send us a few lines to the effect that a personal interview would be needed to arrive at a proper understanding. It is hardly necessary to say that we would not only ask this favour of you if we did not feel convinced that a personal interview will be to mutual advantage."

Electric Hardening Furnaces.—A demonstration of modern methods of heat treatment of steel was recently organised by the Department of Applied Science of Sheffield University, under the supervision of Prof. C. H. Desch. A Wild-Barfield hardening furnace was installed at the Faculty of Metallurgy, and manufacturers were invited to bring samples of their own work to be hardened. It is claimed that where these furnaces are installed on mass production, in no case has the cost exceeded that of gas-fired furnaces, while the uniformity of results, the improved quality of the products, and the beneficial effects on the health of the operatives are strong arguments in favour of the electrical way.

South America.—According to the *Review of the River Plate*, the Compañia Sudamericana de Telefonos L. M. Ericsson has been formed to manufacture telephonic, telegraphic, and electrical materials in general and also "Block" apparatus for railways, &c. Capital, $200,000 m/n, in 2,000 shares of $100 m/n each.

The same contemporary announced a meeting of shareholders of the Compañia Platense de Electricidad Siemens-Schuckert S.A. for February 20th to elect a new board of directors, appoint three sub-managers, and to authorise the new board to treat for the purchase of the assets and liabilities of "Siemens-Schuckert Limitada" ("Compañia de Maquinarias e Instalaciones Eléctricas")

Growing Demand for Electrical Machinery in British Malaya.—With the steady development that is going on in the interior of the British-controlled portion of the Malay Peninsula, there is a growing demand for electrical machinery. This demand is indicated by the following statistics of imports and exports taken from the official records of the Straits Settlements:—

	Imports.	Exports.
	£	£
1917	60,525	18,795
1918	55,189	22,191
1919	153,590	31,795
1920	241,923	51,002

Though classified as exports, the electrical goods sent out of the Straits Settlements do not, to any great extent, leave the Peninsula, but find their way into the Federated and Unfederated Malay States—in 1917 to the value of £14,823; in 1918, £10,317; in 1919, £22,818; and in 1920, £32,497. Manufacturers of electrical machinery will be interested to know whence British Malaya obtains its supplies, and this is shown in the following comparative table:—

	1918.	1919.	1920.
	£	£	£
United Kingdom	17,028	50,430	123,122
U.S.A.	9,179	74,593	46,985
Canada	—	—	25,398
Japan	13,806	811	11,963
Holland	—	—	8,675
Hongkong	1,688	592	7,816
Italy	933	857	5,724
Denmark	—	—	4,777
France	—	—	1,773
Australia	792	1,074	1,024
China	7,674	4,651	898

It will be seen from the above figures that the United States of America took premier position in 1919, to be displaced by the United Kingdom in the latest year for which statistics are available. Canada has come in as a supplier of electrical goods, and it would be interesting to know exactly what proportion of the supplies from Italy, Holland and Denmark originated in those countries and whether any portion came from Central Europe. The imports from Hongkong and the China coast ports may be merely transhipments from Japan, the United States, or elsewhere.

In the Federated Malay States, the supervision of electrical machinery is entrusted to the Senior Warden of Mines, and from Mr. A. R. Mynott's report for 1920 it appears that the number of installations of generating plant in these States was as follows:—1918, 106 (9,360 kW); 1919, 109 (9,544 kW); 1920, 110 (10,376 kW). In addition, there were 45 self-contained low-voltage lighting plants installed in private houses, and about 900 kW of plant was in course of erection at the close of the year. The aggregate kW power of motors employed was 10,047, as against 9,067 in 1919, and 8,911 in 1918.

A classification of all electrical generating plant employed in the Federated Malay States in 1920 was given in kW as follows:—

	Power.	Light.
Mining	9,551	217
Agriculture	56	214
General	109	170
Government	331	2,469
Total	10,047	3,070

Commenting on the statistics, Mr. Mynott says they show that very little progress has been made during the last three years in the utilisation of electrical energy, which, to a great extent, is due to the prevailing high price of machinery and the difficulty in getting orders executed. Two Diesel-driven alternating-current plants, aggregating 900 kW, were in course of erection at the end of the year. Units of this type of moderate size have proved themselves to be reliable and economical in British Malaya.

In the report for 1920 of the Director of Public Works, it is stated that during the greater part of the year many houses in Kuala Lumpur, the capital of the Federated Malay States, were without meters, and the revenue suffered in consequence. In December meters were installed in all the houses. The supply in the town, considering the shortage of material and the condition of the plant, was well maintained, and only one serious stoppage took place. Sale of energy brought in £31,019, against £23,567 in 1919.

Unemployment.—A further decrease in unemployment was shown in the Ministry of Labour returns for March 6th, the total registered as wholly unemployed being 1,811,543, as compared with 1,837,233 a week earlier.

For Sale.—By direction of the Disposal Board, Messrs. Buckell & Ballard will sell by auction, on March 28th, at the Witney Aerodrome, buildings and plant, including electrical machinery, &c.

London County Council Tramways Department invites offers for one Dick, Kerr motor booster set. (See our advertisement pages to-day.)

Italian Trade Fairs.—Active preparations are now being made in connection with two of the most important trade fairs held annually in Italy—one at Milan, from April 12th to 27th, the other at Padua, from June 1st to 15th. Official returns show that at each of the previous fairs in 1921 the amount of business transacted reached 500 million lire. Since Milan is separated by only six hours' railway travel from Padua, it would be possible to exhibit any sort of products in both places within a brief period of time. The number of British firms entering has not been so large as anticipated; but with regard to Padua, applications for space can still be entertained up to and including April 20th, if addressed to the Italian Commercial Delegation, 7 & 8, Norfolk Street, Strand, W.C.2, or to the Anglo-Italian Chamber of Commerce, 4, Queen Street Place, London, E.C.—*Reuter's Trade Service* (Rome).

German Electrical Industry.—A writer in the Austrian journal *Electrotechnik und Maschinenbau* thus describes the present position of the German electrical industry:—Those who visited the autumn fair at Leipzig were impressed by the fact that German industries, and not least the electro-technical, despite all obstacles, were as capable of outstanding effort as ever before. Not only have the big concerns and specialised firms, whose names are known in all countries, known how to maintain their positions, but numerous new firms have started and testify to the capacity and tenacity of the German people and the solidity of German work. It seems even possible that in several departments where the fierce competition had caused the production of unsound and inferior goods the quality, construction and finish had been improved. Anyway, it can be asserted that the German electrical industry, notwithstanding all attacks—from the Versailles treaty, the revolution, the brutal oppression of the kingdom by the victor, the falling away of rich export and import markets, the political economic, and social upheavals—showed not the least sign of declension. Even when the manufacturing industries opposed with all their strength fiscal and treaty modifications as impossible of realisation, the transition from a peace-footing to that of a war-footing and *vice versa* has been a confutation of their pessimism. It may be safely said that by the end of 1919 the difficulties attending these changes were overcome, and that in less than a year the industry was sailing out of the stormy waters of general turmoil into the smooth fairway of normal peace time activity. The need, after the cessation of the war, to fill empty warehouses and to supply long-denied goods contributed greatly to this recovery. The home demand for electrical energy, which so long as the war lasted was artificially held in check, then demanded satisfaction. The new period of heavy loans forced manufacturers to substitute machine power for hand labour. The conviction of the advantages of electric working, which at the beginning of the century could only be fostered by literary efforts, became generally recognised. The farmer, always shy of novelties, became acquainted during the war with its advantages, and was the readier to modernise his methods as his profits accumulated. The dearth of petroleum spread the use of the glow lamp throughout all ranks of society. In consequence the electric supply stations were forced to increase their output; many adopted higher pressures and were able to give out large orders for generators, high-pressure installations, rural networks, &c. The railways, post and telegraph officials, mines and ironworks, many industries and great landowners fed the electrical industry with more or less extensive orders. Foreign buyers also after a time put in an appearance, not only Dutch, Spanish, Swedish and Norwegian, but English, Italian, Belgium and even French. Nevertheless, the figures of German exports for 1920 compared with those of the year before the war show how the electrical industry had suffered. Compared with 1913, the figures for 1920 are only half the amount, and if the value shows increase it is due to the sinking of the exchange quotation of the mark. Exports have fallen off most markedly in machines, cable and wire, as well as high-pressure apparatus. Only low-pressure equipment and heating and cooking apparatus show increase. During the war, in lands formerly valuable clients of Germany, independent practical electrical industries have arisen, protected by tariffs against outside competition, so that exchange differences no longer serve. Hence, for example, Italy in 1920 bought from Germany electrical machinery to the extent of 27,500 dz., against 73,300 dz. in 1913. It is the same with the United States and England. Imports of transformers shrank from 1,300 dz. to about 1,000 dz., and of apparatus from 12,200 dz. to 3,000 dz. Against this rose the exports of machines by over 15,000 dz.; cable and wire from 23,000 dz. in 1913 to 44,600 dz. in 1920. Trade with France also showed expansion; the exports in 1919-20 rose from 78,138 to 143,139 dz.; imports of electrochemical and electrometallurgical products fell in the same period from 433,200 dz. to 274,100 dz., while the exports rose 61,600 dz. to 187,700 dz. It is also notorious that the Austrian and Czecho-Slovakian industries are seeking to make themselves independent of Germany. According to all appearances, the German electrical industry in the future can only count on the sale of its products abroad, when these are distinguished by permanent technical superiority. Hence it is hard to see how the newly started works and firms in this department can continue indefinitely.

The British Industries Fair.—The Lord Mayor of Birmingham presided at an exhibitors' dinner held on March 7th. Mr. J. P. Plant (the hon. treasurer of the Fair Council) proposed the toast of the "Department of Overseas Trade," and Sir W. H. Clark, in responding, said that the fact that the Department had escaped the "Geddes Axe" was a matter for congratulation, and the protest raised against the closing of the Department had shown that British industry was solidly in favour of the Department. He complimented the company upon the excellence of this year's display, and said that no doubt the Birmingham section would continue to be held each year. Col. Cole, of the Board of Trade, also replied.

The Birmingham Section, which closed on Friday, was visited by 40,000 persons, including overseas buyers from all parts of the world. This is considered satisfactory. Mr. H. O. Worrall (the chairman of the Council of the Fair) reported at the close that the amount of business transacted and the prospective business were more considerable than last year, and that with regard to oversea trade especially, there had been a notable increase. The improvement in business was specially marked in the small tool section; and satisfactory reports had been received with regard to hollow-ware (aluminium of superior grades), particularly for the electrical trade; and general ironmongery. Many exhibitors have booked stands for next year's Fair, and in some instances the space has been increased.

Copper and Lead Prices.—Messrs. F. Smith & Co. report March 15th:—Copper (electrolytic) bars, £68 15s., 35s. to 75s. increase; ditto, ditto sheets, no change; ditto, ditto wire rods, £78 15s., 35s. to 75s. increase; ditto h.c. wire, 10 7/16d., ¼d. to 7/16d. increase.

Messrs. James & Shakespeare report March 15th:—Copper bars (best selected), sheet and rods, no change; English pig lead, £22 15s., 10s. increase.

Egyptian Contract for British Manufacturers.—Tenders were recently invited by the Public Works Ministry, Cairo, for the supply and installation of pumping machinery at Atf, in Lower Egypt. This contract was open to manufacturers all over the world, and has now been adjudicated to the Associated British Manufacturers (Egypt), Ltd., at a sum slightly over £E.70,000. The contract was keenly competed for by Swiss, German, French, Dutch, and other manufacturers. The installation forms part of one of the largest pumping stations in Egypt, and the machinery and material to be supplied is all British. It consists of four Willans & Robinson (the English Electric Co., Ltd.) Diesel engines, each direct coupled to a Gwynne pump. Each unit is capable of pumping 6.4 cubic metres of water per second. The electric power required is supplied by two Vickers-Petters semi-Diesel engines direct-coupled to the English Electric generators. The filtering plant is that of the Paterson Engineering Co., and the large sluice valves are supplied by Messrs. Glenfield & Kennedy. —*Board of Trade Journal.*

Wages and Conditions in the Tramway Industry.—The Joint Industrial Council for the Tramway Industry met at the Ministry of Labour on March 9th, and came to an agreement on the revision of the agreement of March, 1919, relating to hours and working conditions on the tramways throughout the country. A scheme was adopted for recommendation to the constituent bodies of employers' and men's organisations. Mr. J. Beckett, secretary of the Municipal Tramways Association, stated that the agreement covered all the outstanding points in dispute. It is understood that it is in the nature of a compromise, and that the guaranteed week of 48 hours is be retained for existing staffs of the tramway undertaking.—*The Times.*

"Summer Time."—In the House of Lords on March 14th, the Summer Time Bill passed through Committee. This measure provides that the alteration shall take place at 2 a.m. on the day after the last Saturday in March (except where this is Easter Day, when it will commence a week earlier), and will continue until the morning after the first Saturday in October. The Bill was approved generally, but exception to it was taken by agricultural interests. On March 9th the French Chamber passed a similar measure after it had been rejected upon its introduction.

The Spanish Tariff.—By an awkward little slip on the part of the printer part of the "Business Notice" on this subject in our last issue appeared at the bottom of page 350 instead of at the bottom right-hand corner of page 337. As many of our readers must have discovered, the Spanish tariff matter concludes at the top of page 338. We apologise for any mystification or confusion, for we can assure our readers that the accident was not a deliberate one, and have told the printer that we have no need for such attempts to expedite the very satisfactory rate at which the Review circulation is moving. No prizes were offered to the first reader discovering the error; had it been so we should have won, for we "spotted" it in going through our first office copies before the Review was actually on sale.

French Railway Orders.—It is reported from Paris that an arrangement has been made in principle between the Thomson-Houston group (Schneider & Jeumont works) and the Orleans Railway Co. for the delivery of all the plant required for the electrification of the latter's system, including locomotives, transformer stations, equipment of the lines, &c. The work will be extended over a period of several years.

Oxford Street Lighting.—With reference to the article upon the above subject which appeared in our last issue (p. 331), Venner Time Switches, Ltd., states that the lights are grouped and controlled by "Venner" apparatus.

Industrial Unrest.—According to Mr. Seebohm Rowntree, the existence of industrial unrest is "a reflection on the ability of industrial administrators." He will elaborate this statement in an address to business men and women to be given on Wednesday, March 22nd, at 3.30 p.m., at Gresham College, Basinghall Street, E.C., under the auspices of the National Movement towards a Christian Order of Industry and Commerce, to which we recently referred. If unrest cannot be obliterated it can at any rate be reduced to insignificant proportions if the nation is disposed to pay the price, according to Mr. Rowntree. The account to be met to secure industrial peace will be under five heads:—(1) Wages; (2) hours; (3) economic security; (4) status of workers; and (5) giving the workers a definite share in the prosperity of the industry in which they are engaged.

Ellison's Chess-players.—M. Kostich, the Serbian chess master, visited Ellison's Perry Barr works on Saturday last and gave a lecture on chess openings to the chess enthusiasts there. We hear that the hints that M. Kostich gave on the way to develop the game and the importance of understanding the why and wherefore of the opening moves were exceedingly useful; particularly so, as the majority of the listeners were inexperienced players. The Ellison men play in the third division of the Birmingham Chess League under the name of the "Induction Club."

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions associated with the electrical trades and industries. In place of the date of application for the trade mark, we propose in future to give the date from which those who desire to oppose the application have a period of one month in which to enter their opposition:—

J. E. (lettering and design). No. 421,231. Machinery and parts of all kinds included in Class 7.—The Jeary Electrical Co., Ltd., 8, Lambeth Hill, London, E.C. March 8th, 1922.

Teletel. No. 420,084. Class 8. Numbering devices for counting and indicating telephone calls, &c.—Wm. Albert Landau, 43, Old Queen Street, Westminster, S.W. March 8th, 1922.

Weeks' Electrical Etching (lettering and design). No. 420,180. Class 6. Electrical etching machines.—Weeks' Photo-Engraving Co., Inc., 923, Sansom Street, New York, U.S.A. March 8th, 1922.

Electricalities. No. 421,329. Class 16. Porcelain and earthenware.—The Cable Accessories Co., Ltd., Britannia Works, Groveland Road, Tividale, Tipton, Staffs. March 8th, 1922.

Rockbestas (lettering and design). No. 402,883. Class 50. Asbestos electrical insulating material.—Martin-Rockwell Corporation, 347, Madison Avenue, New York, U.S. March 8th, 1922.

Book Notices.—"Scientific Papers of the U.S. Bureau of Standards, No. 424, "Mathematical Theory of Induced Voltage in the High-Tension Magneto" (15 cents); No. 425, "Characteristic Soft X-rays from Arcs in Gases and Vapours" (10 cents); No. 426, "Thermal Expansion of Nickel, Monel Metal, Stellite, Stainless Steel, and Aluminium" (10 cents); and No. 427, "Some Effects of the Distributed Capacity Between Inductance Coils and the Ground" (5 cents). Washington: Government Printing Office.

"*Proceedings* of the Physical Society, of London." Vol. XXXIV, Part II (20+xcv pp.). London: Fleetway Press, Ltd. Price 6s. net.—This includes communications on "The Average Range of β-Rays in Different Metals," by G. A. Sutherland, M.A., and L. H. Clark, B.Sc.; "The Sensitivity of Ballistic Galvanometers," by Prof. Ernest Wilson; "The Determination of the Damping Decrement of a Tuning Fork," by R. Ll. Jones, M.A.; and a discussion on "Hygrometry."

"The *Journal* of the Röntgen Society," Vol. XVIII, No. 70, January, 1922 (52 pp.). London: Percy Lund, Humphries and Co., Ltd. Price 5s. net.—This number includes Prof. J. W. Nicholson's Presidential address; "The Physics of the X-ray Tube," by Dr. G. W. C. Kaye; and "Transformer Rectifier Sets," by Mr. M. A. Codd.

"Physico-Chemical Problems Relating to the Soil."—A report of a general discussion held by the Faraday Society in May last (142 pp.). London: The Society. Price 10s. 6d. net.

"Electrically-driven Colliery Winding Engines," by H. Marshall (32 pp.). New Malden, Surrey: Vizetelly & Co., Ltd. (for the Association of Engineering and Shipbuilding Draughtsmen).

The March issue of *Industrial Welfare* (9d. net) contains several articles of value to works' managements and welfare workers. The importance of works magazines is stressed in an article on "Restoring Faith in Industry," by Mr. Lancelot Smith, C.B.E., and useful notes on the running of these magazines are given by an editor of one. The influence of welfare on production is discussed in an article by Mr. Hector McMichael; and methods of dealing with inventions by employés are given.

The title of the *Revue de l'Ingénieur et Index Technique* has been changed to *France-Belgique*, and the offices have been removed to 32, Rue Saint-Christophe, Brussels.

"Sharing Profits with Employés," by J. A. Bowie (pp. ix+222). London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d.

"The *Transactions* of the South African Institute of Electrical Engineers," Vol. XII, Part 2. Price 3s. net.—The paper forming the greater part of this number is on "Mineral Concentration by Alternate Currents," by Mr. W. M. Mordey, past-president I.E.E.

Manufacture of Cables in Japan.—The Nippon Electric Co., an allied company of the International Western Electric Co., of New York, has joined forces with the Sumitomo Electric Wire and Cable Works, of Osaka, one of the oldest commercial enterprises in Japan. A new company has been organised to be known as the Sumitomo Electric Wire and Cable Works, Ltd., for the production of power, telephone and telegraph cable. It has started with a capital of 10,000,000 yen, or about $5,000,000. The Nippon Electric Co. has granted to its new associate the right to use all its manufacturing and engineering information and patents which it receives from the Western Electric, covering the production of cable. The Sumitomo Co., which is primarily a manufacturing concern, on its side has agreed to assist the Nippon Co. in the sale not only of electric wire and cable, but also all its other products.—*Indian Textile Journal.*

Exhibitors' Failings.—Correspondence has been appearing in some of the papers reflecting upon the inattention to visitors that was noticeable at a number of stands at the British Industries Fair. We noticed this failing in a very marked degree ourselves, especially at certain times of the day. It is a long-standing complaint—one that we have often had to ventilate in these pages. We cannot imagine that principals of businesses are responsible for stands being left understaffed and frequently entirely unattended for hours at a stretch when would-be buyers are about; if it were so, what could be more short-sighted after having spent heavily on making an exhibit of their products? And yet we cannot imagine that inattention or disloyalty among their staffs is responsible in many cases; here and there one expects to find a black sheep, but the majority are honourable men. Who, then, is really to blame? Money spent upon exhibiting is largely thrown away unless there be a live, courteous, capable, and not too talkative representative or two in charge.

The Needs of Industry.—Mr. F. Dudley Docker, C.B., in addressing the Midland Branch of the National Union of Manufacturers at Birmingham, said that railway rates and fares were at the base of cheap production. They wanted confidence, not conferences; the latter left the trade very much as it was. Mr. Docker, as the first president of the F.B.I., is well qualified to know something about this matter.

Sir Peter Rylands, another past-president of the F.B.I., in addressing Bradford traders, said a reduction of the income tax, to be effective, must be two shillings in the £. No substantial trade improvements were likely in the next nine months.

In the House of Lords last week Lord Southwark asked the Government to give consideration to the urgent necessity for the immediate reduction of postal charges in the vital interests of the trade and commerce of the country. The subject demanded the attention of the Cabinet, as a reduction in the charges would improve trade and reduce unemployment.

The Morwell Briquetting Plant.—The Federal Government has granted permission to six German engineering experts to enter Victoria for the purpose of supervising the erection of the Morwell brown coal briquetting plant.—*Reuter* (Melbourne).

Local Electrical Exhibition.—An electrical exhibition will be held by the Corporation of Kingston-upon-Thames, at the Baths Hall, from April 3rd to 8th inclusive.

LIGHTING AND POWER NOTES.

Australia. — Muswellbrook (N.S.W.). — The Municipal Council intends to use accumulated profits from its gas undertaking to help finance an electricity scheme for the town.—*Reuter's Trade Service* (Melbourne).

Boston.—Electricity Supply.—The scheme for the supply of electricity to the town will shortly be commenced, and Mr. A. Smith, consulting engineer, has prepared plans for a generating station. A private company is to be formed to carry out the undertaking, which it is estimated will involve an expenditure of £150,000.

Burley (Yorks.).—Electricity Supply.—The Council has under consideration a proposal to supply the district with electricity.

Burton-on-Trent.—New Plant.—The Corporation proposes, subject to the consent of the Electricity Commissioners, to install new plant at the power station at a cost of over £78,000. The matter has been referred to the Finance Committee with a view to the borrowing of the amount required.

Cardiff.—Extension of Supply.—The Electricity Commissioners have granted the application of the Council for permission to supply the districts of Risca, Mynddislyn and Bedwas with electricity.

Continental.—Italy.—According to Prof. Luiggi, Italy possessed in 1915 329 hydro-electric installations of above 300 h.p. capacity, furnishing power equal to 935,000 h.p. In the period 1916-1920 there were added 54 installations, of a total power of 217,120 h.p. At the present time 54 plants are under construction, totalling 359,210 h.p. Hence in a short time over a million and a half h.p. will be supplied by plants of over 300 h.p. capacity. Taking plants below 300 h.p. capacity the total output will shortly reach 1,800,000 h.p.—*Revista delle Industria Elettroferroviarie.*

Doncaster.—Loan.—Application is being made by the Town Council to the Electricity Commissioners for sanction to the borrowing of £10,740 for mains, &c.

Featherstone.—Street Lighting.—The Urban Council has accepted the offer of the Sharlston Colliery Co. for lighting Strathouse by electricity at £3 per lamp per annum.

Glasgow.—Electricity Extensions.—The Electricity Committee proposes to purchase four acres of ground for the purpose of extending the siding accommodation at the Dalmarnock power station at a price of £9,000. The estimated cost of the new works to be constructed is £50,000.

Hastings.—Loan.—The Town Council has applied to the Electricity Commissioners for a loan of £8,327 for laying new mains in the St. Leonard's district.

Hawkshead.—Electricity Supply.—In connection with the proposed scheme for supplying the district with electricity, a canvass of the residents is to be taken to ascertain the number who would be willing to take a supply.

Inverness.—Hydro-electric Scheme.—The Town Council has decided upon a modified hydro-electric scheme for the town and adjoining district. The Bill will be brought forward next session and a company is being formed. It is estimated that the cost of the scheme will be between £125,000 and £200,000.

Leicester.—Year's Working.—The annual report of the electricity department for the past year showed a gross profit of £61,731. After deduction of interest, sinking-fund charges, &c., there was a net surplus of £721.

London.—Harrods' Power House.—At the annual meeting on March 8th the chairman of Messrs. Harrods stated that modern power plant had been installed to supply the firm's large premises in Brompton Road.

Maryborough (Queen's Co.).—Electricity Scheme.—The Town Commissioners have approved of the proposal of municipal electric lighting at a cost of £10,000, to be borrowed in open market, and have appointed a deputation to place the scheme before the Local Government Department of the Irish Provisional Government. The charge for electricity will be 1s. per unit.

Navan.—Scheme Approved.—The Local Government Department of the Provisional Government has approved of the scheme for the supply of electricity to the district.

New Zealand.—Wanganui.—The ratepayers have approved of an electric lighting and tramway scheme, and a loan of £50,000 has been sanctioned to complete the installation of a steam-operated plant.—*Reuter's Trade Service* (Melbourne).

Perth.—Loan.—The Electricity Committee proposes to borrow £5,500 for the extension of mains.

Price Reductions.—Reductions are to be made in the charges for electricity in the following districts: Grimsby, Heywood, Long Eaton, Lynn, Stepney, and Sunderland.

Rotherham.—Financial Relief.—The Town Clerk has reported that as a result of the negotiations with the Disposals and Liquidation Commission of the Treasury the loan of £150,000 made by the Government for the construction of the new power station has been cancelled; this will relieve the Corporation of financial obligations to the extent of £141,000.

Southport.—Change of System.—The electrical engineer has been authorised to arrange with two local companies to put in plant for altering the supply from single-phase to three-phase.

Teignmouth.—Street Lighting.—The Urban Council has accepted the offer of the Electric Lighting Co. for public lighting for five years, at £4 per 100 c.p. lamp, and £6 per 250 c.p. lamp, per annum.

Torquay.—Parliamentary Bill.—The Town Council is promoting a Bill in Parliament for power to purchase the Newton Abbot Electrical Supply Co.'s undertaking in accordance with the agreement under which the Council will supply Newton Abbot with electricity.

Uganda.—Kampala.—A scheme is on foot for the supply of electricity to the district.

Warrington.—Extension of Supply.—The Corporation is extending its cables on the south side of the Manchester Ship Canal as far as Thelwell. Cables are to be laid to Lymm if that authority requires a supply of electricity.

New Sub-station.—The Electricity Commissioners have authorised the Warrington Corporation to borrow the money required for the erection of a sub-station at Latchford Without.

Watford.—Loan.—The Urban Council is applying to the Electricity Commissioners for sanction to a loan of £38,940 for extensions to existing plant.

TRAMWAY AND RAILWAY NOTES.

Bootle.—Restoration of Penny Fares.—Representations are being made to the Liverpool Corporation for the restoration of penny fares on the Bootle Council's section of the tramway system.

Brighton.—Extension of Time.—The Minister of Transport has extended the time of the Brighton Corporation Act, 1912, and the Order, 1917, until August, 1923, for the erection of trolley vehicle equipment.

Continental.—Holland.—The granting of the concession for the electrification and extension of the "Gooische Stoomtram" (director, F. M. Augustijn, Watergraafsmeer) may be expected this year, according to information sent to the Department of Overseas Trade by H.M. Consul-General at Rotterdam. The line Amsterdam-Hilversum will be the first to be electrified, and a power station and annex buildings will be constructed.

The "Zeeuwsch Vlaamsche Tramweg Mij," of Axel (Z), intends laying a new tramline with stations, sheds, &c., in Zealand. The plans will probably be drawn up by Ingenieursbureau W. E. Kramer & H. Polano, Noordeinde, 18a, The Hague. It is expected that the work will be commenced at the end of this year.

Sweden.—The Ways and Water Constructions Board has asked the Government for a concession to construct an electric railway from Ragunda to Ostersund, at a cost of 10,600,000 kr., exclusive of the electrical equipment.

Portugal.—A partial tramway service has been resumed in Lisbon. The cars are being driven by military police.

Italy.—According to *L'Elettricistà*, a report has been presented to the Italian Senate regarding the authorisation of the State Railway Administration to take up bonds for a sum of 440,000,000 lire for the electrification of the State railways. The Trofarello-Roneo line, which includes the Turin-Genoa section, is ready for working, while the conversion has been undertaken of the Roneo-Arquota-Tortona, the Tortona-Nori, and the Voghera-Bivio-Bormida lines. It is hoped to be able to complete the Rome-Tivoli and the Rome-Anzio-Nettune line shortly, after which the Rome-Naples line will be taken in hand. It is anticipated that an additional 500 km. will have been electrified by the beginning of next year. The building of electric locomotives will take from 18 to 21 months, and an order has been placed for 111 locomotives, the estimated cost of which is 165,000,000 lire. A portion of these locomotives will be placed on the lines already in use, while the remainder will be reserved for the lines now under construction.

Edinburgh.—Tramway Electrification.—The controversy regarding the system of electrification to be adopted in Princes Street was revived at a meeting of the Tramways Committee on March 8th, when it was resolved to reconsider the whole question. When approached and asked to call a special meeting of the Council for this purpose, the Lord Provost told the Committee that it was its duty to carry out the Council's decision, arrived at in January, to install the overhead system. The Committee intends to carry the matter further.

Llandudno.—Strike.—The employés of the Llandudno and Colwyn Bay Electric Railway Co. are on strike. The dispute arose over a proposed reduction of 3s. per week in the men's wages, which it was contended was one shilling more than it should have been under the sliding scale agreement. It was finally decided to reduce the wages by 2s. 6d., and this was agreed to by the representative of the Transport and General Workers' Union. The draft agreement, however, stated that all the employés on returning to work were to report to the traffic superintendent and to agree to any rearrangement of the staff. As the traffic superintendent was also on strike, the representative of the Union stated that this meant that one of the inspectors who had returned to work had been appointed traffic superintendent, and he had stated that at the termination of the strike certain men would be dismissed. The men have refused to return to work until this man has been removed.

London.—Underground Scheme Approved.—It was stated last week that the modified scheme of improvements and extensions, submitted to the Government for assistance, by the Underground Railway Companies, had been approved. Employment will be found for over 15,000 men for a period of two years, and the cost is estimated at £5,000,000.

Breakdown.—A train on the District Railway was derailed last Friday by the breaking of an axle. The line was blocked for several hours, and the service between West Brompton and Parson's Green stations was conducted on a single line.

Acquisition of Bexley System.—The L.C.C. is negotiating for the transfer of Bexley tramway lines to its control. The L.C.C. boundary includes only a part of the system, but powers are being sought to acquire those lines which lie without the boundary.

Lower Fares.—The South Metropolitan Electric Tramways Co. has introduced cheap return fares on the Croydon-Sutton and Croydon-Tooting routes.

Uruguay.—Monte Video.—The employés of the tramway company recently struck for higher wages. The company stated that it was impossible to increase wages unless the fares were proportionately raised. The municipality refused to sanction higher fares and gave the company 24 hours in which to resume normal working. This, of course, the company was unable to do, and so the Town Council decided to take over the whole system; to pay the employés the wages they asked for; to inform the Government of its action, and ask for support. The company is protesting in the Courts against this arbitrary action.

TELEGRAPH AND TELEPHONE NOTES.

Denmark.—Wireless Telegraphy.—Negotiations are taking place between the Marconi Co. and the Danish telegraphic department respecting the establishment of wireless telephone traffic between Copenhagen and London. The plans are meeting with strong support from the Danish representatives. The first experiment will be made in the course of the summer.

The use of wireless telegraphy for the forwarding of Press telegrams is, it is said, to be tried in Denmark. The wireless station at Lyngby is to be used as the forwarding station, and the scheme is to be carried out by association with the International Radiotelegraph and Radiotelephone Co.

France.—Eiffel Tower Wireless Station.—The director of the military wireless telegraph service (General Ferrié) has informed the Academy of Sciences that the transmitting plant of the Eiffel Tower wireless station will shortly be made much more powerful, principally in order to enable agriculturists all over France to receive meteorological forecasts now being issued daily from the Tower for their benefit. —*Reuter's Trade Service* (Paris).

Poland.—Telephone Service.—The Swedish Cedergren Telephone Co., which owns the Warsaw telephone system, comprising about 33,000 subscribers, will be taken over by a new concern, which will acquire the Warsaw system as well as the State systems in Lodz, Lublin, Lemberg, Bialistok, Sosnowice, and Drobowicz, and gradually other systems. The combine has received a concession for 25 years.—*Financial Times.*

The Telephone Service.—Toll Exchange.—The London Toll exchange has now been in operation for six months. The area covers roughly all places outside the London area within a 25-mile radius of London, and it is proposed to extend the Toll area to roughly double that radius as soon as possible. The average number of calls made weekly through the Toll exchange has been 32,000, 95 per cent. of which have secured immediate connection. The new exchange has also helped to lessen the time required for communication when calls are made much further afield. Of the 12 million trunk calls formerly made annually, 35 per cent. have been for subscribers in the Toll area, and, relieved of these, the trunk exchange has been able to expedite the remaining work, says *The Times.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Barrow-in-Furness.—Electricity Department. Electrical stores, meters, &c., for 12 months. Electrical engineer.

Bedford.—April 5th. Electricity Department. E.h.p., h.p. and l.p. underground cables for 12 months. (See this issue.)

Cheadle & Gatley.—April 3rd. Urban District Council. E.h.p., m.p., and l.p. mains and street lighting accessories. (March 10th.)

Croydon.—March 27th. Electricity Department. Steam-raising plant, consisting of water-tube boiler, &c. (March 10th.)

Dundee.—March 22nd. Electricity Department. Circulating water pipe-line. Mr. H. Richardson, general manager and engineer.

Edinburgh.—April 15th. Electricity Department. Converting plant for lighting and traction, and d.c. switchgear, for the Portobello station. (March 10th.)

Halifax.—March 21st. Board of Guardians. Electrical fittings for six months. Mr. A. T. Longbottom, clerk to Board of Guardians, Union Offices, Carlton Street, Halifax.

Hove.—March 31st. Electricity Department. L.p. feeder switchboard. (See this issue.)

India.—March 31st. High Commissioner of India. Electric cable. (See this issue.)

Kettering.—March 27th. Electricity Department. Two feeder cables. (See this issue.)

London.—H.M. Office of Works.—April 12th. Supply of electrical engineering labour-in-daywork in the Leeds district. (March 3rd.)

L.C.C.—April 10th. Ash conveyor of the water-immersed, drag-link type, and ash hopper for the Greenwich power station. (March 10th.)

March 27th. Wiring and fitting for electric lighting and power at the Stamford Hill Stores Depôt. (See this issue.)

Portsmouth.—March 22nd. Board of Guardians. Three months' supply of electrical fittings. Mr. H. C. Morrell, Guardians' Offices, St. Mary's Road.

Salford.—Tramways Department. General supplies for six months. General manager, 32, Blackfriars Street, Salford.

South Africa.—Durban.—April 19th. Corporation. Supply of consumers' meters, &c. (see Elec. Rev., December 30th. p. 892). The closing date for tenders has been extended to April 19th. Firms not represented in South Africa are advised by the Department of Overseas Trade to forward tenders as soon as possible to Messrs. Webster, Steel & Co., 5, East India Avenue, E.C.3, the agents of the Corporation.*

Johannesburg.—April 12th. Municipal Council. 15 miles 0000 S.W.G., .4 in., round section, H.D. trolley wire.*

Six 3,000-3,300-V cubicles.*

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Blackpool.—Tramways Committee. Accepted:—

One 25-ton overhead electric travelling crane.—Higginbottom & Mannock.

Bradford.—Tramways Committee.

1,000-kW rotary-converter.—General Electric Co., Ltd.
Two 500-kW rotary-converters.—English Electric Co., Ltd.
Fourteen steel axles for trolley vehicles, £1,167.—Kirkstall Forge Co., Ltd.

Electricity Committee.

Steel nozzle box, vertical turbine.—British Thomson-Houston Co., Ltd.
Feed-water piping for Valley Road station.—Aiton & Co., Ltd.

London.—St. Marylebone.—Electric Supply Committee. Recommended:—

12 Underfeed self-contained stokers (£13,053).—Underfeed Stoker Co., Ltd.
Spare armature for d.c. motor (£312).—English Electric Co., Ltd.

Stepney.—Electricity Supply Committee. Accepted:—

50 tons pitch, £157.—J. Smart & Son.
1,000 rolls 1 in. white tape, £97.—MacLennan & Co.
500 gallons resin oil, £162.—W. T. Henley's Telegraph Works Co., Ltd.

Sunderland.—Town Council. Accepted:—

Oil cooler.—Seriac Radiators, Ltd.
Meters.—Ferranti, Ltd., and Reason Manufacturing Co.

FORTHCOMING EVENTS.

London Electrical Engineers: No. 4 (Newhaven Company).—Saturday, March 18th. At Anderton's Hotel, Fleet Street, E.C. At 6.30 p.m. Annual dinner.

Association of Engineers-in-Charge.—Saturday, March 18th. At St. Bride's Institute, E.C. At 7.30 p.m. Informal discussion on "The Merits of Diesel and Other Oil Engines for Industrial Work."

Royal Institution of Great Britain.—Saturday, March 18th. At Albemarle Street, Piccadilly, W. At 3 p.m. Lecture on "Radio-activity," by Sir Ernest Rutherford, F.R.S.

Batti-Wallahs' Society.—Monday, March 20th. At the Holborn Restaurant. At 1 p.m., luncheon; at 2.30 p.m., annual general meeting.

Electrical Society of Glasgow.—Tuesday, March 21st. At 34, Gordon Street, Glasgow. At 7.30 p.m. Paper on "Organisation," by Mr. P. J. Sims.

Institution of Electrical Engineers.—Thursday, March 23rd. At the Institution, Victoria Embankment. At 5.45 p.m. Special general meeting of Corporate Members and Associates, "*Re* Transfer of Mortgages." 6 p.m., special meeting of Corporate Members to consider, &c., the "By-laws of the Institution"; after the meeting the discussion on "Motor Starters" (adjourned from March 2nd) will be resumed.

(North-Western Centre).—Tuesday, March 21st. At the Engineers' Club, Manchester. At 7 p.m. Informal meeting. Paper on "Specifications and Estimates," by Mr. J. Frith.

(Liverpool Sub-Centre).—Monday, March 20th. At the University, Liverpool. At 7 p.m. Paper on "Interconnection of a.c. Power Stations," by Messrs. L. J. Romero and J. B. Palmer.

Roentgen Society.—Tuesday, March 21st. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Silvanus Thompson Memorial Lecture on "Magnetism—and the Ether," by Sir Oliver Lodge, F.R.S.

Institution of Civil Engineers.—Tuesday, March 21st. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "All-electric Automatic Power Signalling on the Metropolitan Railway," by Mr. W. Willox.

Industrial League and Council.—Wednesday, March 22nd. At Caxton Hall, S.W.1. At 7.30 p.m. Lecture on "Some Common Fallacies on Trade and Industry," by the Rt. Hon. G. N. Barnes, M.P.

Institute of Cost and Works Accountants.—Wednesday, March 22nd. At the Institute of Patent Agents, Staple Inn Buildings, W.C. At 7 p.m. Lecture on "Costing at Longbridge Works," by Sir H. Austin, M.P.

Northampton Engineering College Engineering Society.—Thursday, March 23rd. At St. John Street, E.C. At 5.30 p.m. Paper on "Electric Locomotives," by Mr. R. E. Dickinson.

Manchester Wireless Society.—Thursday, March 23rd. At the Albert Hotel, Piccadilly, Manchester. At 8 p.m. Wireless lecture and demonstration, by Mr. J. Hollingworth.

Physical Society of London.—Friday, March 24th. At the Imperial College of Science, South Kensington. At 5 p.m. Guthrie Lecture, "The Effect of Electric and Magnetic Fields on Spectral Lines," by Prof. N. Bohr, of Copenhagen University.

Institution of Production Engineers.—Friday, March 24th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 7.30 p.m. Paper on "Inspection Methods," by Mr. E. Fairbrother.

Electrical Power Engineers' Association (Southern Division).—Friday, March 24th. At the Institution of Electrical Engineers, Victoria Embankment, S.W. At 7 p.m. Lecture on "Electric Control of Large Amounts of Power," by Dr. C. C. Garrard.

(Derby and District Section).—Thursday, March 23rd. At the Flying Horse Hotel, Nottingham. At 6.45 p.m. Paper on "Power Station Efficiency," by Mr. J. N. Waite.

(Kent Section).—Saturday, March 25th. At the Church Institute, Maidstone. At 6.30 p.m. Lecture on "Petroleum: its Insulating and Lubricating Power," by Mr. E. A. Evans.

Edinburgh Electrical Society.—Friday, March 24th. At the Philosophical Institute. At 8 p.m. Paper on "Magnets," by Mr. J. McEwan Brown.

Junior Institution of Engineers.—Friday, March 24th. At Caxton Hall, S.W. At 8 p.m. Questions and general discussion.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

We continue to receive many inquiries without the necessary stamped addressed envelope for reply. We would, therefore, once again remind inquirers of the simple rules of the Service Department:—

1. Address your inquiries to the Electrical Review, Ltd., Service Department, *and enclose a stamped addressed envelope.*

2. Do not ask for information until you have satisfied yourself that it is not already contained in our advertisement pages.

3. If we are the means of putting you in touch with the firm or firms that you require, do us the favour of mentioning the Electrical Review.

No charge is made for the service.

To complete our answers this week we need the names of suppliers or manufacturers of:—

A portable electric drill, having the initials "B-D" surrounded by a circle and hexagon.

A yellow lacquer for colouring electric lamps.

NOTES.

The Engineering Trade Lock-out.—The lock-out of members of the Amalgamated Engineering Union by firms belonging to the Employers' Federation has been in progress during the week. In London and a number of places A.E.U. men are being allowed to remain at work in non-federated shops. The men locked out and those thrown out of employment in consequence thereof are ineligible for the "dole." There have been various notices, manifestoes, threats and appeals by different parties and organisations. The men say that the employers are out to "smash" the unions; the employers repudiate the suggestion. The employers' notice states that the question at issue is not one of overtime; the main issue is a refusal by the Trade Unions to continue the recognition of the employers' right to exercise managerial functions, unless with the prior consent and approval of the unions. A ballot is being taken of 47 unions associated with the A.E.U. on the question of control, and papers are returnable on March 23rd. The Minister of Labour says he is keeping in close touch with the progress of the dispute, but he did not think it advisable on Tuesday evening to make any statement to the House. Various efforts have been made to secure Government intervention, but such intervention is deprecated by employers. The Church has appealed to both sides to end the dispute as speedily as possible to avoid damage to industry, further unemployment, and untold misery. The General Council of the Trades Union Congress issued a manifesto on Tuesday to the officials and members of affiliated societies, stating that it was evident that the Engineering Employers' Federation had decided to wage war on the A.E.U. and other unions with the object of their complete destruction, and asking that the members of all affiliated unions be warned of that decision. The employers issued a notice denying any such intention, as stated above. The General Council of the Trade Union Congress has now suggested the appointment by the Minister of Labour of a Court of Inquiry into the causes of the lock-out.

On Wednesday the National Joint Labour Council, after conferring with the A.E.U. Executive, decided to urge the Government to set up an inquiry into the dispute, under Part II of the Industrial Courts Act. Messrs. A. Henderson, John Hodge, and others were appointed to wait upon Mr. Chamberlain and Mr. Macnamara at 11 o'clock on Thursday morning. If the inquiry was refused, it was proposed to ask for time for a debate in the House of Commons to-day (Friday).

The negotiations in the shipbuilding industry regarding the proposed withdrawal of the war bonus have not been successful. On Tuesday the employers were willing to revise their demands, altering their proposed immediate wage reduction of 16s. 6d. to a reduction of 10s. per week at the end of March and a further 6s. 6d. at the end of April. The men, however, would not consider a reduction of more than 10s., and this in two 5s. instalments. The negotiations came to an abrupt termination, but information available as we go to press is to the effect that they were to be resumed yesterday, Thursday morning, and that the notices to the workmen had been meanwhile suspended.

Christianity and Industry.—*The Times* has received from the Bishop of Lichfield a manifesto on the engineering dispute signed by a large number of leaders of the churches. It agrees that the ultimate responsibility of management must rest with the employer, but states that a refusal to the workers of any share of control runs counter to a clear moral principle. Such a refusal is a denial of the worth of human personality. The statement re-affirms the principles laid down four years ago in the Report of the Archbishops' Committee on "Christianity and Industrial Problems":—

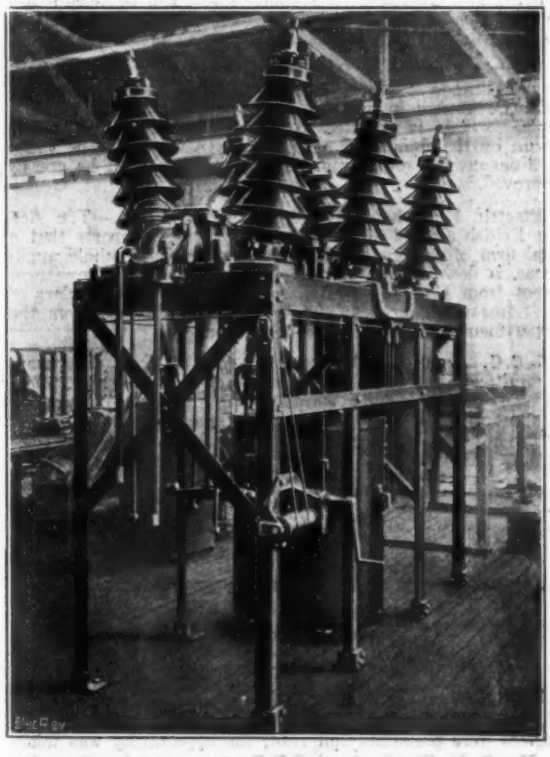
It should be the normal practice in organised trades for the representatives of employers and employed to confer at regular intervals upon such questions affecting the trade as may be suitable for common consideration.

We think that the demand for an increasing share in the control of those industrial conditions upon which the livelihood of the worker depends is one which ought to be met.

We believe that trade unionism, which has proved its value in dealing with the tasks hitherto undertaken by it, offers an instrument through which the worker may obtain an increasing share in the control of industry.

High-Voltage Switchgear. — The Metropolitan-Vickers Electrical Co., Ltd., has shown its belief in the need for switchgear for high voltages, and particularly for outdoor gear, in a practical manner by laying itself out to build it in its works at Trafford Park. In the accompanying illustration is shown a 73,000-volt oil switch in course of construction in the shops. The line of high-voltage outdoor switchgear which it is constructing is practically identical with that built by the Westinghouse Electric & Manufacturing Co. in America. It is thus in no sense an experiment, but a series of thoroughly tried-out engineering designs.

The particular switch illustrated is intended for outdoor use, and has a rated breaking capacity of 300,000 kVA.



Metropolitan-Vickers Outdoor 73,000-V Oil Switch.

Duplicate butt contacts are employed, these being housed in metal castings of smooth profile to avoid corona trouble. For the purpose of the photograph these shields have been omitted in one case, as have also the porcelain sleeves which are fitted to protect from damage by the arc the lower ends of the condenser terminals. On the bench to the right of the switch will be seen the magnet frame and coil for the electrical operating mechanism. When assembled this stands on the floor at the near end of the switch. The long lever shown on the mechanism bracket is removable, and mainly used for setting up the contacts in assembly.

"Unbreakable" Glass.—A Czech engineer, Dr. Horak, is stated to have invented a form of glass which is practically unbreakable by force or heat. One of the experiments carried out with a vessel made of this glass, 1 mm. in thickness, was the filling of the vessel with wood and placing it on a red-hot stove. The wood became charcoal while the glass remained intact. Glass tumblers were repeatedly thrown on the floor and received no injury.

Appointments Vacant.—Assistant switchboard attendants, for the L.C.C. Greenwich generating station; shift engineer, for the Southport Corporation electricity department; technical assistant in the Consumers' and Hiring-out Department for the Barrow-in-Furness Corporation Electricity Department. (See our advertisement pages to-day.)

Educational.—Dundee.—A meeting is to be held of the Joint Consultative Committee of the Technical College and the University College to arrange for the teaching of electrical engineering in the city.

The Cape Technical Institute.—In our issue of July 15th last year we drew attention to the pending completion of the new Institute, and the opportunity which was open to British manufacturers to contribute items of plant for the equipment of the laboratories, thereby assisting the institute, and at the same time securing a permanent advertisement in the eyes of the future buyers of plant in South Africa. We are informed that the staff hopes to remove from the temporary premises at Salt River to the new college in Caledon Square in the course of a few months. Unfortunately only three British firms have so far responded to the appeal and no dynamo makers. It has been difficult to secure quotations for 3- and 10-kW rotary converters. It is hoped that some further orders may be placed in a few weeks. Regarding the above items, the choice seems to lie at present between American plant offered from stock in South Africa and a favourable Yorkshire quotation for about three months' delivery period. The new buildings have a frontage of 272 ft. and 197 ft. on the sides. A main switchboard by Messrs. H. Davies & Co., agents for Messrs. Erskine, Hean and Co., has been placed in the electrical laboratory, controlling a three-wire city supply up to 66 kilowatts (the limit of the overhead feeders) for light and power. This laboratory measures 50 ft. by 30 ft., and is expected to be used for dynamo, motor, and transformer testing, &c., until such time as an extension dynamo-room can be built. Chemistry, physics, engineering, drawing, and mechanics' laboratories of about the above size are also provided, with a library 40 ft. by 30 ft., and a large number of other rooms slightly smaller in size. It is hoped that British manufacturers will not be slow to secure the advantage of a permanent exhibition by a small donation of plant or apparatus, which need not be the most up-to-date pattern. The initial stock got together last year includes one English motor, three foreign motors, various English and foreign instruments and transformers. While the staff prefers British plant it cannot refuse any offer.

The Post Office Tube Railway.—According to a statement issued by the Postmaster-General, on March 10th, the total expenditure to March 31st, 1921, on the Tube railway which is being constructed for the conveyance of parcels and mails to and from the G.P.O. was £1,057,823, of which £185,775 was spent in the financial year ended at the date named. Tunnelling accounts for £767,710, and the other leading items are £73,103 for stations and £72,116 for earthworks, &c.—*The Times.*

The Electro-Harmonic Society.—The Society's final concert of the season was held at Cannon Street Hotel on Friday last. The attendance was notably smaller than at the previous concerts, but the programme was up to the usual level. Mr. A. A. Campbell Swinton, F.R.S., occupied the chair, and a number of excellent vocalists and entertainers appeared. Undoubtedly the principal items of the evening were rendered by Mr. Albert Sammons, the well-known English violinist, and a finished master of his instrument. Mr. Bernard Flanders again acted as accompanist, and the vocalists were Miss Olive Sturgess (soprano), Mr. Joseph Farrington (baritone), and Mr. Oswald Rippon (tenor). Mr. George Ellis provided "philosophy and humour."

The Batti-Wallahs' Dinner.—The eleventh annual dinner (ladies' night) of the Batti-Wallahs' Society takes place at the Holborn Restaurant on Friday, March 31st, at 7.30 o'clock (single tickets, 12s. 6d.; double tickets, 23s.). The Entertainment Secretary's address is 37 and 38, Strand, W.C.2. A special luncheon takes place on Monday next at the Holborn Restaurant, immediately preceding the annual general meeting.

Service Notes.—Warrant Electrician F. L. Weatherden has been posted to the *Vernon*, torpedo ship at Portsmouth from the 10th inst. Mr. Weatherdon got his warrant in July, 1916, and was latterly going duty with the battleship *Resolution*, in the Atlantic Fleet. Warant Electrician F. R. Webber has been posted to the battleship *Royal Sovereign*, from the 13th inst. He got his warrant in 1916, saw service in the North Sea and elsewhere, and was recently of the ship's complement of the *Vernon* at Portsmouth.

Ship Lighting.—The new Italian liner, *Conte Rosso*, just built by Messrs. Beardmore, Dalmuir, Glasgow, is noteworthy as being the first merchant vessel to which the Admiralty practice of fitting a ring main has been applied. This fine passenger and cargo ship for South American long-voyage trade has 3,150 electric lights, and the covering for the main ring cables was specially manufactured. The horse-power of the various motors is 510.

The Testing of Small Electrical Plant.—An interesting paper on the above subject was read by Dr. C. V. Drysdale, O.B.E., before a meeting of the Society of Engineers on March 6th. The author first dealt with electrical instruments, stating that unless entirely separate arrangements were made for d.c. and a.c. testing, good soft iron ammeters were, upon the whole, most suitable. Instruments of the Nalder or Weston repulsion type, with small moving iron, and former wound coils without metal bobbin, had been found most satisfactory. The question of range was of paramount importance in a testing installation, both to reduce the number of instruments and to avoid loss of time through constant changes. The author had therefore given attention to the possibility of extending the range of soft-iron ammeters, and had already succeeded in obtaining an instrument having a 150-fold range and of fairly simple construction. This had been done by increasing the range of the ordinary repulsion instrument by adding a separate attraction iron, thus obtaining a 15-fold range, and constructing the coil of ten similar insulated copper strips having approximately equal magnetic effect and connecting them in different series-parallel combinations by means of a commutator. The ten strips were formed into a two-turn coil, but with an inflection between the turns, so that the outer strip in one turn became the inner strip of the other. A barrel commutator was used. This gave the following combinations: 10 in series; 5 series, 2 parallel; 2 series, 5 parallel; and 10 in parallel; the corresponding current ranges being 1, 2, 5 and 10. The hysteresis error, when the instrument was used for a.c. work, was reduced by the use of a hard steel shaft in the moving system. Regarding voltmeters, the author considered that for combined a.c. and d.c. work the Weston dynamometer voltmeter was most suitable on account of its accuracy and long range. The dynamometer wattmeter was the most suitable for the majority of purposes owing to its strength and portability. The author thought that the best type of frequency meter for tests at ordinary commercial frequencies was a good form of resonant reed instrument, which, when well made, would give readings with an accuracy within one or two tenths per cent. Dr. Clinker had devised a form of deflectional frequency meter in which resonance was obtained with inner circuits composed of a condenser and inductance in series, the latter being varied. Dr. Clinker had arranged the inductance in the form of a moving coil travelling over a tapered electro-magnet excited from the supply. As regarded mechanical testing devices, Dr. Drysdale preferred the stroboscopic device, and he had produced a form of this which enabled speeds to be ascertained with great accuracy. In this a long tapered cone was made to revolve at a known speed, and a light disk, which was movable along the length of the cone, was made to revolve by contact with the cone. When the disk was at a point of equal diameter it would revolve at the same speed as the cone, and this was used in conjunction with the usual tuning fork device to secure small variations from the "stationary-figure" speeds. The author then described some forms of brakes, &c., and dealt at some length with the regenerative dynamometer brake and transmission dynamometers. With regard to testing plant it was thought that a rotary converter with six slip rings was most suitable on a d.c. supply, as it was thus possible to obtain single-, two-, or three-phase current. The arrangement of testing connections was fully dealt with, the motor-testing panel of the Northampton Institute being described as a good example.

Northern Ireland Electricity Commissioners.—The Ministry of Commerce has appointed the following gentlemen to be Electricity Commissioners for Northern Ireland, under the Electricity (Supply) Acts, 1882 to 1919:—Mr. Cecil Litchfield (chairman), Permanent Secretary, Ministry of Commerce; Mr. Walter Abbott, Ministry of Commerce; Mr. George Herbert Edmiston Parr, Ministry of Commerce. Mr. F. W. Parkinson, A.M.I.E.E., has been appointed electricity consultant and adviser to the Commissioners and the Ministry of Commerce.

Railway Telephones.—Mr. W. J. Thorrowgood's recent lecture on the operation and technical details of the London and South-Western Railway Co.'s scheme for substituting telephones for the single-needle telegraphs in the London, Windsor, Reading, Woking, and Guildford area revealed the fact that the telegraph in that area will eventually be entirely displaced by the telephone.

The lecturer explained, according to the *South Western Railway Magazine*, that telephone switchboards were installed at Waterloo, Nine Elms, and Clapham Junction in 1914. Windsor was connected to the new system on January 3rd, Reading on the 16th, and the whole of the area will be similarly connected in a short time, when all stations in the area will be able to communicate telephonically with each other and the offices connected to the Waterloo, Basingstoke, Eastleigh and Southampton telephone exchanges.

Under the telegraph *régime* the mesage had to be written down, sent to the telegraph office, where it was translated into telegraphic language, and signalled to its destination station, where it was retranslated into ordinary language and delivered, and if an answer were required the process had to be repeated in the reverse direction. In the case of a telephone communication, generally the answer can be given at once. There is, therefore, a considerable saving in time and labour, as approximately 120 words per minute can be spoken instead of an average of only 20 in the case of a telegram, but it will still be very necessary to curtail the length of conversations as far as possible to avoid overcrowding the circuits. To limit conversation, unless under exceptional circumstances, is very important, especially when speaking over trunk lines.

The problem of a telephone system for a railway company differs from that which the Post Office has to meet for the public, inasmuch as with a railway company the stations to be connected to the system cover a large area and are by no means concentrated, consequently in principle a switchboard has to be placed at a suitable location, generally at a junction station, so that circuits can be run over the various branches, but instead of each station being connected to the exchange separately, each branch line has, for economical reasons, to include several stations and a system of code calls to be arranged. To avoid repeating all the code calls at the switchboard, every telephone instrument is provided with two ringing keys, one to call the switchboard, and one to call any of the other stations on the circuit. At large stations the various offices are separately connected to the exchange.

There already exist telephone switchboards at Waterloo, Nine Elms, Clapham Junction and Southampton, also small boards at Woking, Basingstoke, and Eastleigh. A new 100-line switchboard has recently been installed at the Feltham Gravitation Shunting Yard to serve the Windsor and Reading lines area. Every station in the district covered by the scheme will be connected to one or other of these switchboards and a number prefixed by the station name of the switchboard will be assigned to each station, which will appear in the company's telephone directory.

When this substitution of telephones for telegraphs in the London area is completed, only nine long-distance circuits will remain at Waterloo, and any telegrams from stations below Woking and Guildford for stations above will be telegraphed to Waterloo and transmitted by telephone to the particular stations, instead of being telegraphed as at present.

Electric Haulage on Canals.—A system of electric haulage on the French Northern Canal between Janville and Pont-l'Eveque is now in operation, and the similar equipment as far as Lesdain is expected to be completed this year, and to Etrun by the middle of next year. In this way the traffic facilities on the route from Paris to Belgium will be greatly improved.

Electric Household Appliances for California.—The Acting British Consul-General at San Francisco reports that a local firm of dealers in china, glassware and household appliances, is desirous of buying household electric appliances direct from United Kingdom manufacturers. Particulars of the name and address of the firm can be obtained from the Department of Overseas Trade, in London.

L.C.C. Tramway Apprentices.—The L.C.C. Highways Committee has revised the terms under which apprentices will serve in the Council's tramway department. The period of apprenticeship is to be not more than five years, entrants being between the ages of 15 and 17 years. Other rules deal with technical education, hours, and wages.

Freemasonry.—The next regular meeting of the Kelvin Lodge will be held at Mark Masons' Hall, Great Queen Street, London, on Friday, March 24th, at 3 p.m.

INSTITUTION NOTES.

Institution of Electrical Engineers.—At the last meeting of the Institution, at which two valuable papers on motor starters were presented and read, the opportunity was taken by Mr. C. H. Wordingham, C.B.E., to present for discussion six draft British Standard Specifications for motor starters, which were submitted to members for criticism. It was decided to adjourn the discussion of the specifications until Thursday, the 23rd inst. It is hoped that as many as possible of those interested in the manufacture, use, and export of motor starters will make a point of attending and giving their views on the specifications in order to assist the Committee to complete them on a satisfactory basis for all concerned.

Western Centre.—The forty-sixth ordinary general meeting of the Centre was held at Bristol on the 6th inst., when Mr. A. C. MacWhirter presided over a very large attendance. The hon. secretary (Mr. C. T. Allan) reported a membership of 489, being an increase of 67 since last October. After the transaction of routine business, Mr. L. H. A. Carr read his paper on "Induction-Type Synchronous Motors," which was illustrated with lantern slides, and followed with sustained interest throughout. At the end of the paper a lively discussion ensued, which was still in progress when the Cardiff

members had to leave to catch their train. The "opposition" was ably led by Major David, whose experience with motors of the type described by Mr. Carr was interesting, and very varied. Mr. Carr confessed that he had listened to one of the best discussions on his paper, and expressed the hope that some of the records exhibited by Major David would be available for publishing in the *Journal*. In addition, Prof. Robertson, Messrs. Weir, Buyers, Chamen, Allan, Plevin, and Atchison contributed to the discussion.

Wireless Telegraph Aerial.—A permanent wireless telegraph aerial has been installed on the Institution building for reception purposes. The details of the installation are as under: Span between strain insulators, 113 ft.; down lead from aerial to leading-in insulator (outside), 63 ft.; down lead from leading-in insulator to the floor of the lecture theatre, 44 ft.; effective length of the aerial (down-lead plus half the span), 163.5 ft. The natural wave length of the aerial is approximately 200 metres.

Edinburgh Electrical Society.—At a meeting of the Society held on March 11th two papers were read: "Installation Work," by Mr. T. M. Buist, and "Fault Localisation," by Mr. D. M. Buist. Mr. T. M. Buist pointed out the risks incurred in cheap and inferior installations by the omission of proper bonding and earthing arrangements and the lack of protecting bushes at conduit ends. He emphasised the importance of complete and rigid inspection for the maintenance of a high standard of wiring work and the need for all wiremen to be familiar with I.E.E. rules. The paper by Mr. D. M. Buist described in detail the procedure in various applications of loop tests.

Institute of Patentees.—At the annual meeting held on March 10th the chairman (Sir William Grey-Wilson) said that 245 inventions had been inspected and reported on during the year, but only a small proportion of them were commercially feasible. The total membership was now about 670. Mr. G. H. Skinner advocated a reform of the Patent Law and the institution of Empire Patents.

Chelmsford Engineering Society.—The second Students' Meeting was held on March 2nd. Mr. P. Matthams read a paper on "Tidal Power Suggestions," describing the causes of variation in the level of the water and the effects of geographical and climatic conditions on the tides. Mr. J. W. Bass read a paper on "Precision Viewing by Light Projection," describing the methods used in the inspection of gauges and screw-threads. Both papers were followed by a good discussion.

Electrical Power Engineers' Association.—A company of about sixty sat down to the first annual dinner of the Midland Division of the Association, under the chairmanship of Mr. T. A. G. Margary, A.M.I.E.E., junior vice-president of the Association.

After the loyal toast Mr. Frank Forrest, M.I.E.E., M.I.Mech.E., chief assistant engineer of the Birmingham electricity supply undertaking, proposed the toast of the "E.P.E.A." After remarking that he considered the terms of the salary schedule fair, Mr. Forrest expressed the hope that the Association would take up the question of tests for engineers looking for promotion in the industry. He advocated tests similar to those at present in use in the marine service, where B.O.T. certificates were granted.

Responding to the toast, Mr. W. J. Jeffery, A.M.I.E.E. (president), claimed that the greatest need of the moment was that the E.P.E.A. should have a 100 per cent. membership, so that it could have greater weight with the employers and manual workers alike in its efforts for constitutional action. Every engineer joining the Association was assisting the moderate man in the manual workers' unions. The president did not agree with Mr. Forrest's suggestions regarding certificates for electricity supply engineers. The question, which had already engaged the attention of a committee in the Midland Division, and was at the present time engaging that of a committee in the Northern Division, required greater consideration than that suggested, and could only be successfully tackled by the united efforts of the employers, educational authorities, and the E.P.E.A. Whilst Mr. Jeffery agreed with Mr. Forrest's views regarding the future, he pointed out that that happy time was a long way off, and that in the intervening years there was likely to be much unemployment in the industry. He hoped that this would receive the attention of the N.J.B. at an early date.

The "Institution of Electrical Engineers" was proposed by Mr. W. J. Oswald, A.M.I.E.E., senior vice-president of the E.P.E.A. He pleaded for greater co-operation between the Institution and the E.P.E.A. Mr. Oswald also referred to the examinations, and stated that it was the desire of the E.P.E.A. to see men trained and brought up in the industry promoted to positions of responsibility. They did not intend that men with only paper qualifications should be pitchforked into generating stations.

Mr. T. P. Wilmshurst, M.B.E., M.I.E.E., (chairman East Midland Sub-centre, Institution of Electrical Engineers) responded and appealed to every member of the E.P.E.A., who had not already done so, to join the Institution.

Mr. J. F. Heslop, A.M.I.E.E. (past-president E.P.E.A.) proposed the "I.M.E.A.," and paid a tribute to the work it carried out for the industry.

Mr. S. T. Allen, M.I.E.E., responding, said that the I.M.E.A. was the oldest association of its kind in the industry. He trusted that when the E.P.E.A. was as old as the I.M.E.A. was at present its leaders would have as good reason to be proud of it.

Diesel Engine Users' Association.—At the next meeting, on Friday, April 7th, at the Institution of Electrical Engineers, a paper on "Some Characteristics of Petroleum Oil used on Diesel Engines," by Mr. Harold Moore, M.Sc.Tech., is to be read and discussed. Non-members desirous of attending the meeting can make application for tickets of admission to the Honorary Secretary, at 19, Cadogan Gardens, London, S.W.3.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

We are privileged in being able to publish a recent photograph of Mr. George Sutton, the chairman and managing director of W. T. Henley's Telegraph Works Co., Ltd., whose speech delivered at the annual meeting of that company was reported in our last issue. So long as there has been a British electrical industry of any importance there has been a Henley's company, and for the last forty-one years Mr. Sutton's heart and soul have been in that business. It was not always so firmly based as it is to-day, and the extent to which the shareholders were indebted to Mr. Sutton for piloting the concern through troubled waters is a story which is remembered to-day by only comparatively few. It was in the beginning of 1881 that Mr. Sutton began his career with Henley's, serving the company as secretary, then as manager, and later, as now, in the position of

The City Studio] [*London.*

Mr. George Sutton,
Chairman and Managing Director of W. T. Henley's Telegraph Works Co., Ltd.

managing director and chairman. There are men who have chosen to divide their attentions amongst a large number of interests, and in the end have had reason to feel that they might have done better had they concentrated their thought, skill, and enterprise upon one good thing and made a success of that. Mr. Sutton, after forty years and more, has no need for regret that he chose the latter and the better course, for Henley's is to-day most largely the prosperous and reputable business that it is because of the whole-hearted way in which its present chairman devoted himself to its interests. Over forty years at the helm of one business might stamp some men as veterans, but there is little of the veteran about Mr. Sutton, if a veteran is a man played out. His speech reported last week shows as enlightened a view as ever of the position of the electrical industry and as alert a mind as any with regard to the adoption of sound yet enterprising policy designed to meet future possibilities. We well remember the terms of praise with which the former chairman, Mr. Sydney Gedge (still a director), referred to the value of his work in the early days, thirty years ago or thereabouts, since when there has been no turning back, the company having had one continuous record of success. The electrical industry has a number of men who on the commercial and financial side of manufacturing businesses are

experts of the highest eminence, and Mr. Sutton is unquestionably one of these. The appreciation of his company was shown in a very happy manner twelve years ago this month when he was presented with his portrait painted by Sir Luke Fildes, and a service of plate for Mrs. Sutton, for which purposes £1,000 was voted at the annual meeting held in 1909. In an article published in the Electrical Review of March 11th, 1910, entitled "Mr. Sutton of Henley's," we referred to the backing of his efforts by Mr. Gedge, by his co-directors, and by a faithful staff, and Mr. Sutton expressed his own personal indebtedness to Mr. Hatton (of the North Woolwich works) (now a director), with whom he had been so long and so happily associated. Our readers will hardly need reminding of the most excellent manner in which Mr. Sutton filled the office of chairman of the Electrical Trades Benevolent Institution in 1913.

At a meeting of the Dublin Corporation, on the motion for the adoption of a report recommending the retirement of Mr. Fred. J. Allen, secretary of the Electricity Supply Committee, Alderman Shields said Mr. Allen's salary was £905 per annum, made up of £600 as salary proper and £305 as bonus, and now it was proposed to give him £603 as pension—in other words, his regular salary. If Mr. Allen had been pensioned under the old reorganisation scheme he would have got £362, and £316 would have been his pension allowance under the British Civil Service method. He proposed, as an amendment, that the pension be fixed at £362. This was seconded by Mr. White, but, after discussion, was defeated. A further amendment, asking that the report be sent back to the Committee, was also defeated, and the original motion for the adoption of the report was then carried.

Mr. F. G. Miller, who has been appointed staff engineer to the Heatherwood Hospital, Ascot, Berks., desires to receive catalogues and lists of electrical goods, machine and engineers' tools, &c.

Mr. M. H. Bollinger, superintending engineer to Messrs. Turnbull & Jones, Ltd., electrical engineers and contractors, of Wellington, Dunedin, and other cities in New Zealand, is at present in England on a business trip. His address is c/o Messrs. Sanderson, Murray & Elder, Ltd., 2, Gresham Buildings, Basinghall Street, London, E.C.

We find that the information given in our "Personal" note of last week with reference to the Tonbridge appointments was not quite correct. The appointments that have been made are these:—Mr. C. F. Button has been appointed assistant engineer and Mr. F. Springate mains superintendent.

The Times reports that Mr. Theodore Stevens, M.Inst.C.E., has been appointed to the new London University College lectureship in the Faculty of Engineering on the Utilisation of Water Power.

Mr. E. Pickbourn (proprietor of the G. & P. Electrical Co., of Nottingham) is to be married at Nottingham on Monday next to Miss E. Killingley.

Mr. C. L. Dalton, of Birmingham, has joined the staff of Mr. Maurice G. Parker (advertising service), at Suffolk House, Suffolk Street, Birmingham.

Mr. A. Walkington, who has represented the Electrical Engineering & Equipment Co., Ltd., in the Midlands and Yorkshire for the past three years, has been appointed district manager at Nottingham.

Obituary.—We regret to record the death of Mr. J. J. Walklate, general controller and Town Clerk of the City of Auckland, N.Z. He went out to New Zealand about 15 years ago to take charge of the City of Auckland Electric Tramways, Ltd., now owned by the Corporation. According to the *Birmingham Post*, Mr. Walklate was engaged with Mr. Alfred Dickinson in the construction of the first overhead trolley tramway in this country (Darlaston and Walsall). Later he was connected with the Douglas and Laxey, Brisbane, Kidderminster, and Potteries District tramways. He passed away on March 4th at the age of 52 years.

Augustus Desire Waller.—We regret to announce the death of Dr. A. D. Waller, F.R.S., Director of the Physiological Laboratory, University of London, on Saturday last, at the age of 66. He had an international reputation for research, and devised the first electrocardiograph; he also carried out investigations with regard to the detection and recording of emotional states in the human subject, and made observations on the electrical phenomena accompanying the growth of plants, besides conducting many other researches not of an electrical character.

Mr. P. Foulds.—The death is announced of Mr. Percy Foulds, who was in business as an electrical engineer and contractor at Heaton Moor, Stockport.

Mr. Harry Brakes, M.B.E., A.M.Inst.E.E., district electrical engineer, Eastern Division G.E.R., died suddenly at Ipswich.

Mr. Matthew Blackwood.—The death is reported, at the age of 73 years, of Mr. Matthew Blackwood, partner in a sawmilling business, but also described by the Press as one of the pioneers in the West of Scotland of X-ray and electrical treatment, whose house was like a miniature hospital and whose advice was sought by medical men throughout the country.

Wills.—The late Dr. Edward Hopkinson left £141,675 gross and £157,306 net personalty.

The late Mr. C. Lock, a director of the Monte Video Telephone Co., Ltd., left £143,394 gross.

NEW COMPANIES REGISTERED.

Olso-Light Co., Ltd. (180,211).—Private company. Registered March 9th. Capital, £6,000 in £1 shares. To carry on the business of manufacturers, importers and shippers of and dealers in merchandise, including electric lighting and heating requisites, &c. The first directors are: J. O'Malley-Davies, 47, Victoria Street, S.W.1 (chairman and managing director); C. B. Liddell, 62, Park Street, W.1. Qualification, £5. Registered office: 47, Victoria Street, S.W.1.

Radio-Constructa, Ltd. (180,126).—Private company. Registered March 6th. Capital, £500 in £1 shares. To adopt an agreement with G. H. Moody, and to carry on the business of manufacturers of and dealers in wireless telegraphic and telephonic apparatus and appliances and electrical apparatus and accessories, &c. The first directors are: H. D. Butler, 222, Great Dover Street, S.E., wireless engineer; G. H. Moody, 134, Coteford Street, Tooting, S.W.17, wireless engineer. Qualification, 25 shares. Solicitor: W. I. Thomas, 72, Chancery Lane, W.C.

General Electro-Motives, Ltd. (180,239).—Private company. Registered March 10th. Capital, £5,000 in £1 shares. To acquire the benefit of an agreement between Electromobile, Ltd., and J. A. Popplewell and F. E. Popplewell and to carry on the business of electrical, mechanical and general engineers, motor car, cab, omnibus, and van proprietors, &c. The life directors are: J. A. Popplewell, The Grove, Halton, Leeds, provision merchant; F. E. Popplewell, Pinfold Lane, Halton, Leeds, engineer. Qualification, £50. Remuneration as fixed by the company. Registered office: 62, Hunslet Road, Leeds.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

H. S. Kemp & Co., Ltd.—Mortgage debenture dated March 1st, 1922, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Belco, Ltd., Windsor House, Kingsway, W.C.

Chagford and Devon Electric Light Co., Ltd.—Particulars of £8,000 debentures authorised February 15th, 1922; whole amount issued; charged on the company's property, present and future, including uncalled capital.

A. Robinson & Co., Ltd.—Satisfaction in full on February 20th, 1922, of debenture dated June 14th, 1921, securing £10,000.

Debenture dated February 21st, 1922, to secure £10,000 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Bank of Liverpool and Martins.

Dubilier Condenser Co. (1921), Ltd.—Debenture dated February 13th, 1922, to secure £7,000, charged on certain leasehold property and the company's undertaking and property, present and future, including uncalled capital. Holders: T. Henderson and T. O. Hope, 75, Cornhill, E.C.3.

Cordoba Light, Power and Traction Co., Ltd.—Trust deed dated February 10th, 1922 (supplemental to trust deed dated March 12th, 1909), to secure £572,602 debenture stock, making with £27,398 outstanding under original deed £1,000,000, charged on the company's undertaking and property, including uncalled capital, with special provisions with regard to shares in Cordoba Light and Power Co., of Maine, U.S.A., and Cordoba (Argentine) Electric Tramways Construction Co., Ltd. Trustees: C. W. Trotter, C.B., and W. K. Whigham.

Catchpole and Maurice, Ltd.—Satisfaction in full on February 22nd, 1922, of debenture dated October 5th, 1921, securing £500.

Henderson & Thornton, Ltd.—Particulars of £500 debentures authorised January 9th, 1922; whole amount issued; charged on the company's undertaking and property, present and future.

Gosport and Alverstoke Electric Lighting Co., Ltd. (82,633).—Return dated January 14th, 1922. Capital, £25,000 in £10 shares. 2,400 shares taken up and paid for in full. Mortgages and charges, nil.

Phœnix Dynamo Manufacturing Co., Ltd. (77,660).—Return dated December 29th, 1921. Capital, £60,000 in 48,400 ordinary shares of £1 each and 1,160 preference shares of £10 each. 29,007 ordinary and 1,160 preference shares taken up. £1 per share called up on 8,007 ordinary and £10 per share on 1,160 preference shares. £19,007 paid. £21,000 considered as paid on 21,000 ordinary shares. Mortgages and charges, nil.

Montevideo Telephone Co., Ltd. (27,208).—Return dated November 24th, 1921. Capital £220,000 in £1 shares. 217,135 shares taken up. £217,135 considered as paid. Mortgages and charges, nil.

Simplex Conduits, Ltd. (88,290).—Return dated December 22nd, 1921. Capital, £100,000 in 50,000 ordinary shares of £1 each and 10,000 preference shares of £5 each. 40,000 ordinary and 10,000 preference shares taken up. £50,000 paid on the preference and £40,000 considered as paid on the ordinary. Mortgages and charges, nil.

Amazon Telegraph Co., Ltd. (44,532).—Return dated November 29th, 1921. Capital, £250,000 in £10 shares. All shares taken up. £250,000 paid. Mortgages and charges, £200,200.

Bullers, Ltd. (62,020).—Return dated January 4th, 1922. Capital, £400,000 in £10 shares (20,000 ordinary and 20,000 preference), 15,500 ordinary and 15,000 preference shares taken up. £150,070 paid on seven ordinary and 15,000 preference. £154,930 considered as paid on 15,493 ordinary. Mortgages and charges, £243,050.

Robert W. Blackwell & Co., Ltd. (63,446).—Return dated January 13th, 1922. Capital, £50,000 in £1 shares. All shares taken up. £18,338 paid. £31,662 considered as paid. Mortgages and charges, nil.

Burmah Electric Tramways and Lighting Co., Ltd. (75,090).—Return dated January 5th, 1922. Capital, £200,000 in £5 shares (20,000 ordinary and 20,000 preference). All shares taken up. £100,000 paid on the preference. £100,000 considered as paid on the ordinary. Mortgages and charges, nil.

B. E. Manufacturing Co., Ltd.—Particulars of £3,000 debentures, authorised February 28th, 1922; present issue £2,350; charged on the company's undertaking and property, present and future, including uncalled capital.

Woking Electric Supply Co., Ltd.—Issue on June 11th, 1922, of £110 debentures, part of a series already registered.

Hexham and District Electric Supply Co., Ltd.—Satisfaction in full on February 24th, 1922, of debentures dated January 31st, 1921, securing £10,000.

CITY NOTES.

Charing Cross, West End and City Electricity Supply Co., Ltd.

The annual general meeting of the company was held on March 9th, Mr. W. F. Fladgate, M.V.O., presiding. The chairman said that the coal strike had involved a loss of revenue and had necessitated increased expenditure. The lack of coal was compensated for by fitting several of the boilers with oil-burning appliances. The warm weather which prevailed during the greater part of the year had also caused a loss of revenue owing to the falling-off of the heating load. Against these circumstances could be set the increase in connections and sales and the reduction in working costs. The expenditure on repairs to mains and plant formed a large item in the revenue account, and there was also an increase of £2,000 in rates and taxes. Over £100,000 had been spent on the City plant, but they were not yet reaping the benefits which they hoped to derive from this plant. The increase in net revenue was very satisfactory; the question of reduced prices had been considered and the directors were satisfied that something could be done in this direction during the current year. The chairman then reviewed the proposals recently put forward for the re-organisation of electricity supply in London, and mentioned the last Electricity Bill. He spoke against the Corporation Profits Tax, and stated that the company was making a protest against its continuance in common with other electricity suppliers.

Midland Counties Electric Supply Co., Ltd.

Viscount Chilston, G.B.E., presided at the annual meeting held in London on March 7th. He said that no new undertakings had been acquired during the year, and the properties owned by the company, therefore still consisted of: the Leicestershire & Warwickshire Electric Power Co., the Derbyshire and Nottinghamshire Electric Power Co., the Ilkeston Electric Lighting Undertaking, the Midland Electric Light & Power Co., Ltd., the Leamington & Warwick Electrical Co., Ltd., the Nottinghamshire & Derbyshire Tramways Co., the Ilkeston Tramways, and the Cheltenham & District Light Railway Co.

Notwithstanding the coal strike and general depression the output of the two power companies had increased, the number of units sold being 15,131,938, as against 11,640,266 in the previous year. There was still a large number of prospective consumers awaiting connection. The gross receipts of the power companies amounted to £167,561, as compared with £129,323. Four Special Orders for supplying certain districts were applied for during the year; two of these, the Belper and District, and the Bedworth and Bulkington Orders had been granted. The Wigston Magna and District Order had been made by the Electricity Commissioners and awaited Parliamentary sanction. The fourth had been delayed by the action of the local authorities. The Derbyshire & Nottinghamshire Electric Power Co. was being seriously prejudiced by the Commissioners' refusal to permit the erection of a station on the Trent. The City of Nottingham had delayed the erection of its station, and if the company's application had been sanctioned a supply would have been available for all purposes. Referring to the Electricity Bill before the House of Lords, the chairman said that he hoped that this measure would share the fate of its predecessors in the interests of the public at large. The traction undertakings had naturally suffered from the effects of the coal strike and trade depression, and consequently the revenue from this source fell from £117,562 to £112,676, and the number of passengers from 11,949,134 to 9,167,304. With regard to the accounts, Viscount Chilston said that the issue of £200,000 short-term notes had been repaid out of the proceeds of the issue of £400,000 7½ per cent. debenture stock in November last. This issue was largely over-subscribed, and now commanded a substantial premium on the Stock Exchange.

Metropolitan Electric Supply Co., Ltd.

The annual general meeting was held on March 7th. The chairman (Mr. A. W. Tait, C.B.E.) stated that the falling-off in the consumption of power was in a large measure counter-balanced by the increase in the number of connections of new lighting consumers and the removal of lighting restrictions. He anticipated that the lighting and heating load would continue to grow, but he was doubtful whether the power load would increase to any extent in the current year in consequence of the trade depression. Development in the company's western area was continued owing to the commencement of fresh industries. It was satisfactory to note that the new connections during the year amounted to 4,217 kW, as compared with 3,374 kW in 1920, apart from the connections to the mains of the Uxbridge company. The increase in generation and distribution costs (£4,000) was remarkably small considering the increased price of coal. Costs had been minimised by supplying the whole of the Ironbridge sub-station area from the Uxbridge station instead of from Willesden. This accounted for the large increase in the item "purchase of current." Another factor which kept down costs was the improved efficiency of the Willesden station, which should be even better when the new sets were in operation. The peak of high prices had been passed and the company had already made reductions in the power rate for small consumers, and the chairman hoped that further decreases would soon be made. The company, in common with other companies, was protesting against the continuance of the Corporation Profits Tax. It was expected that the new 20,000-kW set at Willesden would be put into operation in June next, and that the whole scheme would be completed before the end of the year.

Underground Electric Railways Co. of London, Ltd.

Lord Ashfield presided at the annual meeting on March 9th. In presenting the report and accounts he reviewed the results of the operating companies' working during the year, accounts of which appeared in the Electrical Review dated February 24th (p. 277), and March 3rd (p. 312). He said that there was a prospect of much-reduced expenditure during the present year, and this was essential when the falling-off of traffic was considered. The latter was due to reduced fares on tramways and omnibuses, and to the widespread lack of money. He did not anticipate worse results than those of the previous year, however. Economies had been effected in all departments, and notably in the repairing and overhauling of omnibuses, for which a central works at Chiswick had been opened, and rolling stock had been improved, resulting in greater speed of operation and increased convenience to passengers. Lord Ashfield then referred to the revised Common Fund agreement and explained its effects upon the financial arrangements of the contributing companies. The main reason for the revision was to ensure that no individual company would be maintained in an artificial state of prosperity; the fund was for the adjustment or equalisation of temporary fluctuations of fortune only. The chairman then summarised the working results of the Associated Equipment Co. This company incurred a loss of £28,000 in 1921, which had to be set off against a profit of £158,000 in the previous year. Turning to the capital side of the operating companies' accounts, the chairman said that a more straitened situation was unfolded. The Metropolitan District Railway Co. had overspent its capital account by £1,007,000, and had outstanding commitments of £191,000. The London Electric Railway Co. had overspent £561,000, and its commitments amounted to £162,000. The L.G.O.C. had expended £504,000 in excess of its receipts and had incurred a further liability of £273,000. These made a total of almost £2,000,000. The re-arrangement of the capital of the A.E.C. was mentioned, and the chairman then spoke of the projected extensions and improvements for the execution of which State assistance was being sought. Upon referring to the balance sheet of the company, Lord Ashfield mentioned the various outstanding charges, including the £700,000 6 per cent. 3-year secured notes, which had to be redeemed in 1923, and summarised the capital position as "unstable." The results of the operating companies were satisfactory, but he could not say the same of this company's results. Not only had there been a failure to earn the full interest charges on the 6 per cent. income bonds, but the long-patient shareholder was without anything at all. Nevertheless, when he compared the situation when the income bonds were created to the present position he saw some grounds for being less discouraged. In spite of complaints he thought that the operating companies had distributed in dividends as much as they were able to distribute. The directors considered that a careful review of the financial situation of the company should be made and a scheme, which he hoped would be acceptable, would be worked out and presented during the current year.

Telegraph Construction & Maintenance Co., Ltd.

Mr. Colin F. Campbell, presiding at the meeting on March 9th, referred to the death of Sir James Pender, the senior director, in whose place they had elected Major H. Denison-Pender, a nephew of Sir James Pender and grandson of the late Sir John Pender, the founder of the company. Mr. Campbell said that the year had been one of great difficulty for all connected with commerce. Their company was not so directly concerned with banking and finance as with the position of manufacturers generally, and it was from that point of view they had to consider the position more particularly. A year ago the chairman drew their attention to the heavy fall that had taken place in the prices of raw materials. Since then there had been a small but continuous decline in prices, although none of the materials with which they were mostly concerned had yet reached the pre-war figures. It might be argued that the fall in prices was to their advantage. In a sense that was true, but in a company such as theirs considerable stocks had always to be maintained, with the consequence that if prices continued to fall from one value to another, confidence in the stability of prices generally was apt to be shaken. Last year however, they were fortunate in being able to keep their works and ships fairly well occupied, and they had little doubt that when trade revived they would be able to secure a fair share of the business to be done. The result of the year was a net profit of £120,880, which was an improvement of £10,693 over the previous year. In the balance sheet the capital still stood at £896,400, and they might congratulate themselves on not having had to increase it or to issue debentures, as many companies had been forced to do to carry on through these difficult times. The reserve fund was £160,000, and they were building that up at the rate of £20,000 a year. At the present time, in his opinion, the reserve fund was too small for a company of that standing, though it was, to some extent, made up for by the carry forward. The balance at credit of profit

and loss—£213,858—was £11,241 better than last year. On the other side of the balance sheet the item of property, including stocks, stood at £1,149,000, which was £402,000 down, mostly the result of the fall in prices and materials, which still continued. Their output of submarine cable was less last year than in the previous twelve months, due to the great coal strike, which for some time restricted their supplies of wire, and their turnover was also down. The satisfactory figures which they were able to submit were rather suprising in face of those two facts, but one thing which had affected the account considerably was that depreciation for investments no longer had to be provided for. During the war, and since, every year had shown a fall in the value of their securities, averaging about £50,000 a year, which had to be allowed for before arriving at the net profits. That depreciation had absorbed all the dividends and interest that the investments paid, and in some years considerably more. The beginning of 1921 seemed to have been the low-water mark in gilt-edged securities, and on December 31st last there was a general rise, which had helped them very much in the year's accounts.

Bruce Peebles and Co., Ltd.

The report for 1921 that is to be submitted at the annual meeting at Edinburgh to-day shows a profit, including interest, &c., after deducting administrative expenses and debenture charges, of £113,793 plus £5,823 brought forward. There is put to taxation reserve £40,000, to depreciation reserve £10,000, and to general reserve £32,221. After paying 7½ per cent. per annum, less income tax, on the preference shares, and a further dividend of 2½ per cent. for the year, less tax, making 10 per cent., the ordinary shares receive 10 per cent. and a bonus of 5 per cent. for the year, both less income tax, and £7,919 is to be carried forward. The results for the year are satisfactory, the output from the works having been the largest in the history of the company. The prospects for the current year are good. The reserve account, by the appropriation of £32,221 out of the profits of the year, now stands at £100,000. Resolutions fixing the directors' fees at £250 each, and giving power to vote extra remuneration, are to be moved at the meeting.

London and Suburban Traction Co., Ltd.

At the annual general meeting, held on March 8th, Lord Ashfield (chairman) said that in spite of the falling-off in traffic, due to trade depression and reduced services during the coal strike, the net earnings of the company had increased. This was principally due to the increased fares and to the economies effected in working. For the year ended March 31st, 1921, the average earnings per car-mile on the company's undertakings were 11 per cent. better than on the municipal systems, and the average cost of operation per car-mile was 5 per cent. lower, the period of comparison being the same. This was due to better management. He was well aware that low fares were necessary to the growth of a metropolitan area, but the result of the action of the L.C.C. in abandoning, in December last, the increases granted in September, 1920, would be seen in its annual accounts. The reductions made on the tramways in which the company was interested were on a more moderate scale, with the result that the companies' earnings were not seriously prejudiced.

Oxford Electric Co., Ltd.

Sir Henry Mance, presiding at the annual meeting on March 13th, said that they had to deal with the high costs of fuel and wages, though the latter might show an appreciable decrease during 1922 unless the cost of living rose again. Welsh coal in their bunkers at the end of 1921 cost over 70 per cent. more than the pre-war price. The present tariff did not cover the increased charges, and while these continued they could not consider reduction in the price of energy. So far the Electricity Commissioners had taken no steps to form an electrical area in the company's part of England. He presumed that whatever happened the company would remain the distributing agency, and so must extend its mains as the demand increased. The directors were anxious to postpone all capital expenditure as long as possible, but they might have to issue some additional capital this year for mains extensions.

Notting Hill Electric Lighting Co., Ltd.

The annual general meeting was held on March 7th, Mr. A. E. Franklin, J.P., presiding. The chairman said that the share capital remained the same, but the loan capital had been increased by the issue of £25,000 seven-year 7½ per cent. notes. The installation of two new 500-kW rotary converters had increased the capital expenditure by £14,916. The balance of profit, £38,219, was the largest made so far, and would have been larger had the coal strike not occurred. The generating costs were lower, due to the increased efficiency at the Wood Lane station, although an additional amount of 292,000 units was produced. Distribution costs were also decreased. Management expenses increased, and rates and taxes were equivalent to 1d. per unit sold. Referring to the dividend of 8s. per share, free of tax upon the ordinary shares, the chairman said that it was proposed to alter the title of these shares to prevent misunderstanding, in view of the fact that the dividend was equal to 800 per cent. upon the nominal value of the shares. The facts were as follows:—The old £10 shares were split, and each shareholder on paying 1s. had his share split, part representing 6 per cent., and called preferential, and the balance, the rest of the dividend. The full dividend, had they been united, would have been about 11½ per cent., less tax. Mr. Franklin briefly referred to the last Electricity Supply Bill and to the Commissioners' proposals for the reorganisation of London electricity supply. With regard to the latter, the directors were awaiting developments before framing a scheme to put before the shareholders.

The report and accounts were adopted, and at a subsequent extraordinary general meeting it was resolved to alter the title of the 27,050 shilling shares, mentioned above, to "deferred shares."

Davis and Timmins, Ltd.

The directors report a net loss of £12,850 for 1921, due to depreciation in the value of stock on hand at December, 1920. A claim for the repayment of E.P.D. with regard to this depreciation has been made, but no amount in respect of this claim has been credited in the present accounts. The balance brought forward from 1920 amounted to £53,535, from which has to be deducted the net loss for 1921, the interim dividend paid in September on the preference shares, £1,800, that on the ordinary shares at the rate of 6 per cent. per annum for the half-year to June 30th, 1921, £1,410, and after placing £15,585 to income tax account in respect of 1920, there remains a balance of £21,891. The six months' dividend on the preference shares, at 6 per cent. per annum to December, 1921, absorbs £1,800, and it is proposed to pay a balance dividend at the rate of 10 per cent. per annum on the ordinary shares for the last half of 1921, making 8 per cent. per annum for the year (free of income tax), leaving to be carried forward, but subject to the taxation of the year, the amount of which is at present unascertained, £17,741.

German Companies.

The *Bergmann Electricity Undertakings Co.*, which is the holding company of the manufacturing concern of this name, reports net profits of 257,000 marks for 1920-21, which sum has been carried forward. In 1919-20 the net profits were 40,000 marks.

The *Elektrizitats A.G. vorm Schuckert & Co.*, of Nuremberg, reports net profits of 14,551,000 marks for 1920-21 and a dividend at the rate of 16½ per cent. on share capital of 70,000,000 marks. A rate of 10 per cent. was distributed in the preceding year.

The *Hochfrequenz-Machinen A.G.*, of Berlin (high-frequency machines for wireless telegraphy), proposes to pay for 1921 a dividend at the rate of 30 per cent. on the "A" shares, as compared with 25 per cent. in 1920, when a rate of 92.8 per cent. was also distributed on the "B" shares. It is now intended to raise the share capital from 3,500,000 to 8,000,000 marks.

The *Osram Co.*, of Berlin, according to the prospectus inviting subscriptions to the new loan reported in a previous issue, earned net profits of 30,300,000 marks in 1920-21, permitting of the payment of a dividend at the rate of 25 per cent. to the three proprietary companies (A.E.G., Siemens and Halske, and the Auer-Koppel group). In 1919-20 the net profits were 27,010,000 marks, and the rate of distribution was higher on a smaller amount of capital.

The *Gesellschaft Fabrik Isolirter Drahte zu Elektrischen Zwecken*, of Adlershof, Berlin, has just invited applications for 26,000 new ordinary shares of 1,000 marks each, issued at a premium of 150 per cent.

French Companies.

Compagnie Générale d'Electricité.—The net profits for the year totalled 7,223,127 fr., being less by 147,687 fr. than those of the foregoing year. Including the carry over of the preceding year of 1,279,053 fr., the available balance was raised to 8,502,180 fr., out of which a dividend of 60 per cent. was declared. The manifold manufactures of the company's various industrial works and, above all, the success of its several distribution undertakings, enabled the company to bear the consequences of the general economic crisis in a way better than might have been expected. During the year the company had carried out two important operations: the departments "Vincey tubes" and "glow lamps" had been handed over to newly-created companies, interest in which was retained. After reference to the seven off-shoot companies in which the parent company is concerned, it was decided to increase the present capital of 50,000,000 fr. by the issue of 3,571,000 fr. in shares, allocated to the Société de l'Accumulateur Tudor as consideration for its assets.

Union d'Electricité.—This company is now issuing 80,000 6 per cent. 500-fr. bonds at 472 fr. cash. The building of the great Gennevilliers station, of a capacity of 200,000 kW. is completed, and the company is now in a position to supply the wants of its Parisian customers.

Compagnie Générale Electrique.—At an extraordinary meeting of this company held on December 20th it was decided to raise the capital, on one or several occasions, from 15 to 30 million francs, with an understanding that preference would be given to the old shareholders.

It is announced that the *Société de l'Ouest Lumière*, which supplies energy in the western suburbs of Paris, has now been incorporated in the group formed by the Union d'Electricité, to whose activity we recently referred at some length. As the former has now sold its Puteaux generating station to the latter the company is now merely acting as a distributor for the Union.

The *Secteur électrique du Nord de la Gironde*, which is the style of the former Energie electrique de Courtras, has raised its capital to 2,000,000 fr., and arranged an amalgamation with the Energie electrique Oubrazaise in order to extend its network beyond the Gironde as far as Blaye, Bourg, and Saint André de Cubzac.

The *Société électrique du Toulois* has raised its capital from 400,000 to 750,000 fr., in order to extend its network, which now serves some fifty localities, and will shortly serve one hundred, including the Valleys d'Ornain, Gondecourt, and Ligney-en-Barrois, where are situated important mines.

The Siemens-Schuckert Group.

The report of the Siemens & Halske Co., which deals with the year ended on September 30th, 1921, states that a considerable improvement in the production took place as compared with the preceding year, and raw and other materials were more easily obtainable. Most departments of the works were well occupied during the year. The hourly output reached the 1913 level in the case of many groups of piece workmen, but it was still far behind with time workmen, particularly the unskilled men. As a consequence, the share of unproductive wages was still very high as compared with the pre-war period. Despite the increase in the number of workmen, the electrical engineering production had not yet attained the former piece output. The sale prices were further unnecessarily increased through the disproportionately high augmentation of the general unproductive administration works which were brought about by a number of legal and local Government measures which had been insufficiently thought out.

The expected advantages from the community of interests with the Gelsenkirchen Deutsch-Luxemburg and the Schuckert Companies which began with the opening of 1920-21, had been realised; the supply of raw materials, semi-finished materials and manufactures improved both in constancy and kind, and the extensive sales' organisation was of advantage to the whole group, particularly in oversea countries. As to the manufacturing agreement with the glow lamp works, it is merely mentioned that this arrangement had corresponded to expectations.

The report further states that the volume of foreign orders received was satisfactory, particularly for cables, automatic telephone exchanges, water meters and electro-medical appliances. The first long-distance telephone cable between Berlin and Rhineland was completed. For the laying of further long-distance cables, which could be carried out with a smaller cross-section of copper by the use of a booster (reinforcing) apparatus which had been developed, the company had formed the German Distance Cable Co. in conjunction with the Federal Postal Administration and other firms. The railway safety apparatus department suffered from the almost complete absence of orders from the State railways. The construction of benzine motors had to be greatly restricted owing to the Allied veto on the building of aeroplanes. In other branches new types of motors were developed and the manufacture begun. The Siemens Constructional Union Co. was constituted in conjunction with the Siemens-Schuckert Works and the Schuckert Co., for the utilisation of the experience of the departments for electric railways and waterworks. It is further mentioned that the Wireless Telegraphy Co. was meeting with success in its efforts further to develop its system in overland and oversea traffic.

The report of the Siemens-Schuckert Works, which also refers to the financial year ended on September 30th, 1921, states that the year assumed a quieter course than the preceding twelve months. As a consequence of the more stable foreign value of the mark, the prices for inland and foreign raw materials were not subject to great fluctuations; wages remained on the same level, there were no strikes, and it was possible to execute orders with greater regularity. The orders received from abroad did not exceed the usual measure owing to the depression prevailing in many foreign countries. The fall in the mark since August led to a rapid and large influx of orders, and this situation and the simultaneous increase in all prices, salaries and wages, continued in the early months of the new financial year; but it was now already recognised that this influx only represented a compression of the requirements of German industry, and that replacements and new orders would have been distributed over a longer period if a quieter situation of the market had prevailed.

In connection with the exploitation of the water-powers in South Germany, the report states that the company received orders for a large part of the requisite machines, and considerable orders were also booked for similar works in Central and North Germany. Heavy driving plants were ordered by collieries and iron and steel works both for home and foreign account, and a similar state of affairs existed with the chemical, textile and paper industries, as well as with the metal industry, particularly for electric welding plant. Some revival was noticed in the electric railway branch, and the turnover in motors, meters and conductors considerably increased.

The directors of the Elektrizitats Gesellschaft (late Schuckert), of Nuremberg, state that they could look back with satisfaction on the first year of harmonious and profitable co-operation in the community of interests (Rhine-Elbe-Schuckert Union), and they expected these conditions to continue in the future. Concerning the company's own particular sphere, the report states that proposals for new works applied principally to the exploitation of power stations and transport installations, frequently based upon the use of water powers, and the company took an active part in the existing projects. On the other hand, activity in other countries was still hampered by the uncertain political and economic conditions, and partly also on account of the unfavourable level of German exchange. The settlement of the company's foreign claims (Petrograd, Paris and Barcelona) on the basis of the Peace Treaty was still in abeyance, although the German Government had sanctioned and paid advances in the matter. Various relations had been entered into for the extension of the company's activity to other industrial branches, and these held out the prospect of being successful.

Cambridge Electric Supply Co., Ltd.—At the annual meeting the chairman (Mr. R. F. Scott) said that the profit was approximately £3,500 greater than that of the previous year. The increased price of 8d. per unit was put into force in October last and would stand for three years. Considerable sums had been spent on mains extensions, and since the last meeting £4,450 had been raised by means of 7½ per cent. debentures. The raising of further capital during the current year was forecasted.

Ferguson, Pailin, Ltd.—The net profit for the year ended November 30th was £19,638, making, with £7,937 brought forward, £27,575. The directors recommend a further dividend of 4½ per cent. on the preference shares, making 7 per cent. for the year, and a further dividend of 9½ per cent. on the ordinary shares, making 13 per cent. for the year; to reserve, £2,000; carrying forward £15,264, subject to E.P.D. for two years to November 30th, 1920, and corporation tax for two years to November 30th, 1921.

Electrical Distribution of Yorkshire, Ltd.—Mr. R. W. Wickham, presiding at the annual meeting on March 7th, said that the effects of the coal trade dispute and the trade depression were reflected in their sales of electricity, but many new customers had come forward, with the result that the profits had been increased. It was proposed to issue about 50,000 shares of £1 each to cover extensions. For the tenth year in succession a dividend of 6 per cent., free of tax, had been paid.

Companies to be Struck off the Register.—The following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

Bright's Light & Power, Ltd.
British Engineering Co. (London), Ltd.
Drycells, Ltd.
Electric Floor Machine Co., Ltd.
London & Provincial Electric Co., Ltd.

Commonwealth Edison Co.—Net electric operating revenue for 1921 was $12,743,676, net operating income $8,787,744, other income $739,586, gross income $9,527,330, less deductions $1,326,503, leaving $8,200,827; interest on funded debt $2,834,042, available for dividends $5,366,785; dividends paid absorbed $4,307,126; carried to surplus $1,059,659. —*Financial News.*

American Telephone and Telegraph Co.—The net earnings for 1921, after meeting all operating expenses and providing for depreciation and all taxes, were $73,523,813; deducting interest $19,521,109, dividends $42,674,403, and appropriated for contingencies $3,000,000, the balance for surplus was $8,328,301.

North Melbourne Electric Tramways and Lighting Co., Ltd.—The report for 1921 shows gross receipts of £53,683, against £45,764, and net income of £13,232, against £11,228. Interest was paid on £167,000 5 per cent. debentures and a balance of £4,882 carried to reserve for renewals and upkeep.

British Insulated and Helsby Cables, Ltd.—Further dividend on the ordinary shares of 6¼ per cent., and a bonus of 5 per cent., making with the interim dividend a total distribution of 15 per cent. for 1921. For reserves and depreciation £35,000 is allocated, and £362,000 is carried forward.

Brush Electrical Engineering Co., Ltd.—The directors report the net profit for 1921 at £232,602, an increase of £41,500 over 1920. £15,000 is put to depreciation and £73,190 to general reserve. Dividend on the ordinary shares 15 p.c. cent., carrying forward £214,100, subject to taxation.

Argentine Tramways and Power Co.—A meeting has been called for March 22nd to consider a scheme of arrangement under which the preference and ordinary £5 shares are to be divided up into £1 shares, and the claims to dividend arrears are to be varied.

Stock Exchange Notices.—Application has been made to the Committee to allow the following to be quoted officially:

Thames Valley Electric Power Board.—£350,000 6 per cent. debentures of £100 each (guaranteed by the Government of New Zealand).

Stewart & Lloyds, Ltd.—The directors announce a dividend of 2s. per share and a bonus of 6d. on the deferred shares, also a dividend of 1s. 6d. and a bonus of 4½d., free of tax, on the new shares.

Newcastle and District Electric Lighting Co., Ltd.—Dividend 4 per cent. per annum, less income tax, carrying forward £13,725.

Mirrlees Watson Co., Ltd.—Dividend of 10 per cent. and a bonus of 2½ per cent., both less tax.

Capital Issues in France.—Among the new issues of capital raised in France in 1921 may be mentioned a total of 128,000,000 fr. in the case of tramways and secondary railways, and 496,000,000 fr. in the electricity supply industry.

Manila Electric Corporation.—A dividend of 1½ per cent. on the common capital for the quarter ending March 31st is announced.

Midland Electric Corporation for Power Distribution, Ltd.—A dividend of 6 per cent., making 10 per cent. for the year, is announced, leaving £30,604 to be carried forward.

Direct Spanish Telegraph Co., Ltd.—Dividends for 1921: 10 per cent. on the preference shares, less income tax; 10 per cent. on the ordinary shares, free of income tax.

STOCKS AND SHARES.

Tuesday Evening.

A distinct check has been given to the buoyancy of the Stock Exchange markets. The serious turn which events took in South Africa, the disquieting news from India, the situation in Ireland, and the engineering lock-out at home made up a quartette of factors which led to Stock Exchange business being brought up with a round turn. Prices in some cases gave way fairly sharply, though by no means to the same extent as they had previously advanced. For instance, the War Loan, after touching 96½, fell back nearly a couple of points, though the decline is small when measured against the amount of the previous rise, and there has been an appreciable recovery. Home Railway stocks fell back in sympathy.

At the same time, those particular markets in which investment has been most persistent of late exhibit little indication of a change of front. There is no weakness, for example, in the market for electricity supply shares, where the publication of dividends and reports has brought about a substantial rise spread over the past few weeks. In markets such as these, where the investor pure and simple is at work, quotations are fully maintained, though where speculation joined hands with investment in swinging-up prices, the setback is fairly general.

The Home Railway market, as already noticed, has come back fairly substantially from the best prices which it reached. The steam stocks are nearly all down. There has been something of a run upon such low-priced stocks as those in companies which are going to be taken into the big groups. Welsh railway stocks also are particularly strong. Nearer London, however, the Undergrounds have given way. The 1s. shares are lower at 5s. 6d., but the Income Bonds, after being down to 71, recovered to 71½. Mr. Hilton Young, in the House of Commons on Tuesday night, said that the Government had agreed to guarantee a loan to the Underground Electric Railways of London for the purpose of extending and altering the tube railways. Mr. Young did not think it desirable to give details at present, but the scheme is estimated to provide work for fifteen to twenty thousand men for eighteen months to two years. The scheme, of course, is for the extension of the tubes in various directions.

Meanwhile, languid interest has been aroused by a report to the effect that Mr. Ford, of motor fame, is coming over here with certain oil interests in order to set up a charabanc system on the roads, making a start with 500 cars. No particular importance is attached to the rumour. It is rather interesting to recall that in the years gone by, large sums of money were found by American interests, on both sides of the Atlantic, for financing the tubes in the early days, *e.g.*, of the Great Northern & Piccadilly and the Charing Cross & Hampstead lines.

Districts are a better market at 27¼, but Metropolitans, after their recent vivid rise, reacted to 26½. Central London assented ordinary stock is harder at 62.

The excellent dividend performances of the home electricity supply companies continue to be reflected in noticeable strength amongst the leading shares. Prominent in the upward movement are the ordinary shares of the County of London Co., which have risen to 11¼, the preferences being higher at 9⅛. Charing Cross ordinary are steady at their advanced price of 5¼ and the preference hardened to 3⅛. Kensingtons gave way to 5¾, but South Londons are better at £3. City of London at 33s. 9d. are 1/16 up; Westminster ordinary gave way to 6⅛ after their recent substantial improvement. Announcement of the various dividends enables us to give the complete table of distributions for 1921, together with the yields on the shares, brought up to date.

In the slight depression which developed during the early part of the week, a number of the shorter-dated new issue stocks went back from their recent top levels. The electricity debentures are somewhat prominent amongst these, and Llanellys at 100, Fife 99¼, Shropshire 101, and Reading at 103¼ are all lower than they have stood recently. The North Metropolitan 8 per cent. preference stock gave way to ¼ premium. Yorkshire Power Electric 6 per cent. preference, after being 8s. premium, are a trifle easier at 7s. premium. Scottish Power 8 per cent. second preference remain at 20s. 6d. The British Insulated Co. declares a dividend repeating the previous 15 per cent., and the price remains good at 36s. 3d.

Telegraph Constructions at 25½ are 10s. higher. Henleys improved to 2, a rise of 6s. 3d. in a fortnight. Callenders are steady at 1¼. The strength of these shares has drawn attention to Johnson & Phillips ordinary, and the price has hardened a little to 17s. 6d. The company's dividend in respect of the past year is on the point of announcement, and against the 12½ per cent. paid last year, the market is looking for 10 per cent. in respect of 1921. If expectations are realised and 10 per cent. is paid on the increased capital, it will certainly be a good performance.

Brazilian Tractions are better at 40, and there are no fresh changes in the Anglo-Argentine group. Mexican issues are weaker, Mexican Light & Power Bonds going back 3 points to 62½.

Amongst cable shares, the strength of the Eastern group is further emphasised by a rise of 2 points in Eastern ordinary stock, while Westerns at 18⅜ are 7s. 6d. higher on the week. Globe preference rose to 10½. Indo-Europeans have risen £1 to 35. United River Plate Telephones at 6⅞ are 1/16 lower, but the company's 4½ per cent. debenture at 76½ is 3 points to the good. Oriental Telephone 4 per cent. debenture at 76½ is up 10. Direct Spanish shares improved to 9½. Costa Rica Electric 5 per cent. debentures have come into the Stock Exchange lists at 25. British Electric Traction preference hardened to 72½. The ordinary is quoted at 44½.

Metropolitan-Vickers preference at 2 are 1/16 better. Edisons gave way to 4s., and General Electrics to 20s. 3d. The rubber market is quietly firm. The recent rally in prices has not brought about any noticeable increase in the volume of business. Babcocks are 3/16 up to 27s. 8d., the engineering trouble having the paradoxical effect of bringing in buyers.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Mar. 14, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7⅜	+ ⅛	£8 5 6
Charing Cross Ordinary	8	9	6¼	—	7 18 3
do. do. do. 4½ Pref.	4½	4½	3⅛	+ ⅛	6 18 4
Chelsea	6	6	4¼	—	7 1 2
City of London	14	14	11¼	—	8 6 0
do. do. 6 per cent. Pref.	6	6	1	—	6 0 0
County of London	8	8	11⅛	+ ⅛	7 3 10
do. do. 5 per cent. Pref.	6	6	9⅞	+ ⅛	6 8 0
Kensington Ordinary	9	10	5¾	— ⅛	8 13 10
London Electric	2½	4	1½xd	+2/-	9 11 8
do. do. 6 per cent. Pref.	6	6	4½xd	+ ⅛	7 5 5
Metropolitan	7	7	4¾	—	7 7 4
do. 4½ per cent. Pref.	4½	4½	3⅛	—	6 8 7
St. James' and Pall Mall	12	12	7⅜	—	8 2 8
South London	7	7	8	+ ⅛	9 6 8
South Metropolitan Pref.	7	7	1½xd	—	6 4 5
Westminster Ordinary	10	10	6⅜	— ⅛	7 11
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	97	—	6 3 9
do. Def.	1½	1½	22	—	7 18 6
Chile Telephone	6	6	5¾	— ⅛	5 11 7
Cuba Sub. Ord.	7	7	7⅜	+ ⅛	9 3 8
Eastern Extension	10	10	13½	—	6 8 1
Eastern Tel. Ord.	10	10	18⅞	+2	5 6 8
Globe Tel. and T. Ord.	10	10	18⅜	—	5 6 8
do. do. Pref.	6	6	10⅝	+ ⅛	5 10 4
Great Northern Tel.	22	24	23½	—	8 8 3
Indo-European	10	10	35	+1	7 2 10
Marconi	25	15	1⅛	—	7 14 8
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	6¼	— ⅛	*5 16 5
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18⅜	+ ⅛	*5 6 8
Home Rails.					
Central London Ord. Assented	4	4	62xd	+2	6 9 1
Metropolitan	1½	1½	36½	—1	6 8 3
do. District	Nil	Nil	9⅞	+ ⅛	8 12 9
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	5/6	—6d.	Nil
do. do. Income	4	2	7½	—	*5 12 0
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8⅞	—	8 9 0
do. do. 2nd Pref.	Nil	5½	3⅝	—	8 8 0
do. do. 5 per cent. Deb.	5	5	75	—	6 13 4
Brazil Tractions	Nil	Nil	40	+1	Nil
British Columbia Elec. Rly. Pfcs.	5	5	64½	+1	7 16 6
do. do. Preferred	5	90/-	60½	—	*7 13 0
do. do. Deferred	3	120/-	60½	—	*10 5 6
do. do. Deb.	4½	4½	67⅞	—	6 7 9
Mexico Trams. 5 per cent. Bonds	Nil	Nil	68½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	90⅜	—	Nil
Mexican Light Common	Nil	Nil	16⅝	—1	Nil
do. Pref.	Nil	Nil	90⅜	—	Nil
do. 1st Bonds	Nil	5	62½	—⅜	8 0 0
Manufacturing Companies					
Babcock & Wilcox	15	15	27/-	— ⅛	5 11 4
British Aluminium Ord.	10	10	15/-	—	—
British Insulated Ord.	15	15	1½	+ ⅛	8 5 6
Callenders	15	15	1¼	—	8 11 6
,, 6½ Pref.	6½	6½	1/-	—	6 7 4
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	—	4/-	—6d.	—
do. do. 5 per cent. Deb.	5	5	62	—	8 1 4
Electric Construction	10	10	18/9	—	10 13 4
English Electric	8	8	9/6	—6d.	16 17 0
do. Pref.	6	6	18/9	—	8 14 6
Gen. Elec. Pref.	6½	6½	20/9	—	6 5 4
do. Ord.	10	10	20/6	—1/-	9 17 6
Henley	15	15	2	+ ⅛	8 7 10
do. 4½ Pref.	4½	4½	4xd	+ ⅛	5 12 6
India-Rubber	10	—	⅛	—	—
Met.-Vickers Pref.	8	8	2	+ 1/16	8 0 0
Siemens Ord.	10	10	25/-	—	*8 0 0
Telegraph Con.	20	20	25½	+⅛	*4 14 4

* Dividends paid free of Income Tax.

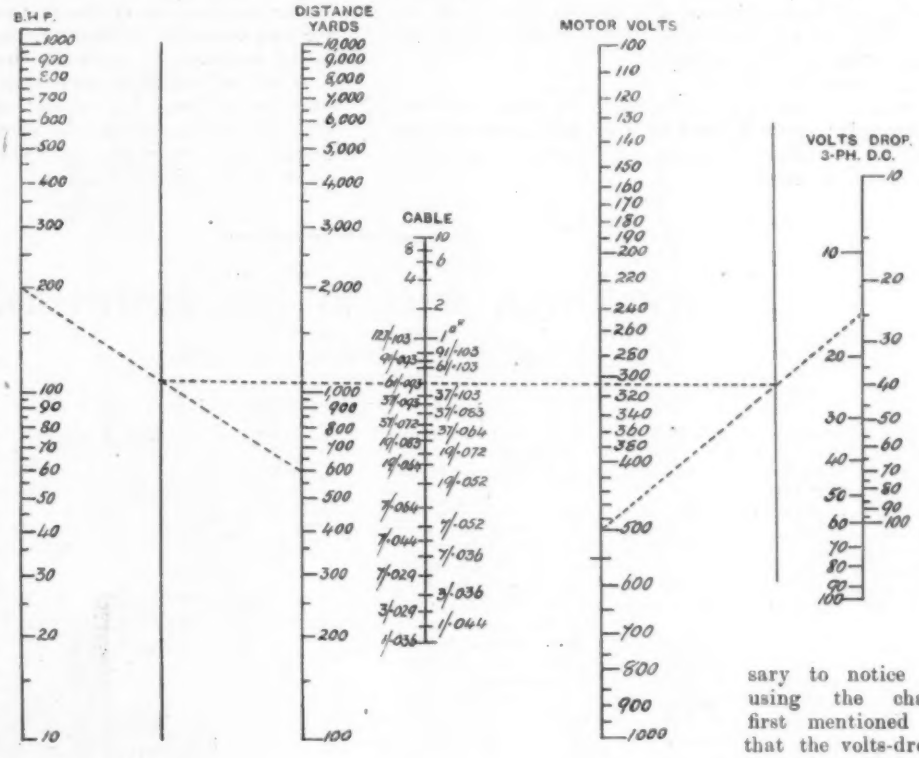
CABLE CHARTS AND CABLE CALCULATIONS.

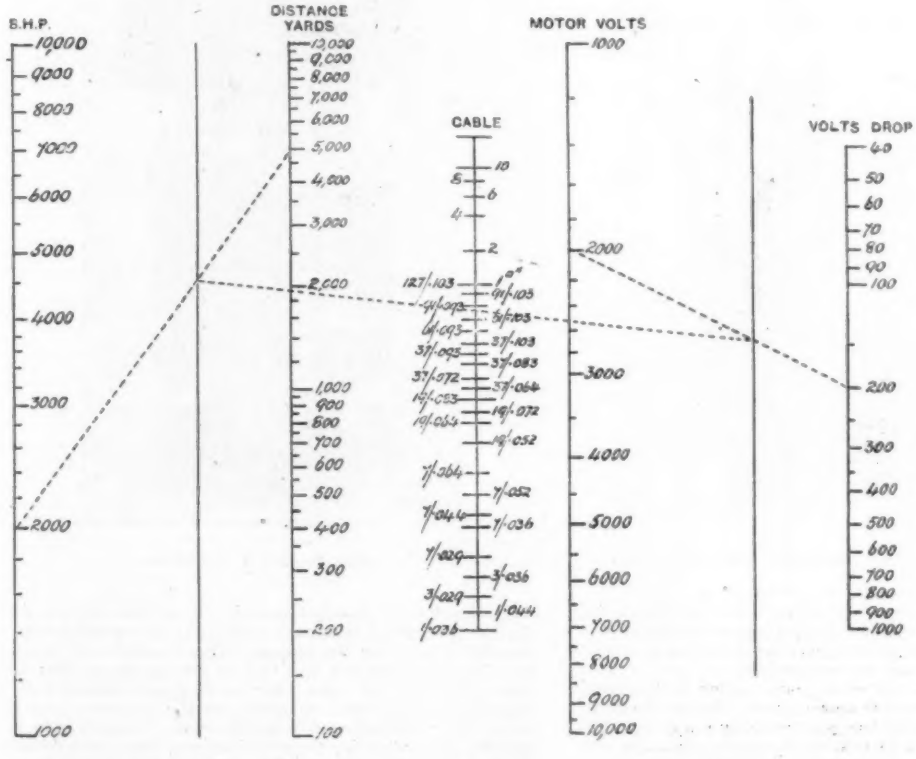
By "ANODE."

Alignment charts are fairly well known to mechanical engineers, but up to now are not so familiar to electrical engineers, and the fact that this is so must serve as the reason for the explanation of the charts given herewith being rather lengthy.

The fact that considerably higher voltages are used in a.c. than in d.c. transmission accounts for the chart being in two portions, one dealing with pressures from 100 to 1,000 volts, which covers the d.c. voltages generally met with in this country, and the other dealing with pressures from 1,000 to 10,000 volts, which will deal with all ordinary three-phase transmission.

No account is taken of inductance, as this is not likely to have much effect in the distances covered by the charts. The chart





dealing with horse-powers from 10 to 1,000 is used for both three-phase alternating current and direct current calculations, while the one dealing with horse-power from 1,000 to 10,000 is solely used for three-phase alternating-current calculations, and the only point necessary to notice in using the chart first mentioned is that the volts-drop line is scaled on both sides, the scaling on the left being used for three-phase calculations, and that on the right for direct-current calculations. The distances given are those from the source of supply to the motor.

The cable sizes are in accordance with the latest lists of the British Engineering Standards Association, and cable sizes are given, as being handier than the corresponding measurements in square inches.

The lines headed require no explanation; those not headed are denominated "support lines," and require no scaling.

Let us take as an example the following case:—It is proposed to install a 500-volt 200-h.p. d.c. motor at a distance of 600 yards from the source of supply, the

pressure drop in the line being fixed at 25 volts. Required, the size of cable necessary.

I. Place a straight-edge across from 200 on the b.h.p. line to 600 on the distance line, and note where the support line between these two is intersected.

II. Place a straight-edge across from 500 on "motor volts" to 25 on "volts drop" line (using the right-hand scaling, as it is d.c.), and again note where the support line is intersected.

III. Next place the straight-edge across from the points of intersection on the support lines, and where the cable line is intersected, read off the size of cable necessary, in this case 61/.093.

Another example:—

Motor, 2,000 h.p.; distance, 5,000 yards from source of supply; motor volts, 2,000; drop in cable, 200 volts; three-phase alternating-current supply. Required, the size of cable necessary.

I. Place the straight-edge across from 2,000 on the b.h.p. line to 5,000 on the distance line, noting where the support line between these two is intersected.

II. Place the straight-edge across from 2,000 on the motor volts line to 200 on the volts drop line, again noting the point of intersection of the support line.

III. Through these points of intersection lay a straight-edge across the cable line; it will be found that it passes between 61/.103 and 91/.093, and nearer the latter, which we take.

For the purpose of demonstration the joining lines for both examples are shown dotted, but in actual use it is not necessary to mark the chart.

It will, of course, be understood that the chart can be used for various other calculations, such as finding the drop in the line when the other data are given, or finding the pressure necessary to transmit a given power under stated conditions.

HIGH-POWER MERCURY ARC RECTIFIERS.

By R. L. MORRISON, A.M.I.E.E.

(*Continued from page* 355.)

The main anodes (fig. 4, p. 355), made of pure close-grained iron, are screwed to the anode bolts, which serve to convey the current to them, the transformer connections being made to the upper part of these bolts. The anodes and bolts are carefully insulated from the anode plate by specially-designed leading-through insulators, the portion nearest the anodes being provided with screening hoods formed integral with them. To the latter are fitted the sheet-iron arc guides F, at the mouth of which are provided slats, which break up the arc and eliminate the effect of the ultra-violet rays. These arc guides terminate in a large collecting funnel J, while immediately above the cathode there is a smaller funnel T, terminating in a thin cylindrical insulator, the purpose of which is to protect the main cathode insulator. The arc operates between the main anodes E and the cathode, while it will be seen that its path is well defined, which eliminates, to a large extent, the possibility of back-firing. Just below the condensing cylinder there is a mercury collector H, into which

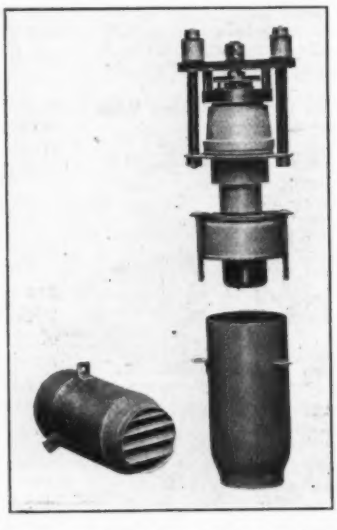


Fig. 5.—Anode, showing Arc Guide and Insulators.

the condensed mercury drops, and it is then led by the sloping troughs to the walls of the arc chamber, down which it runs and finds its way back to the cathode, so that there is no loss and the mercury need never be replenished.

Both cylinders are water cooled, the water first passing through the cathode base N, from whence it is led to the jacket round the arc chamber and the anode plate by the connections O, after which it passes to the jacket surrounding the condensing cylinder and then out to waste or to a separate re-cooling system. Down the centre of the rectifier passes the rod connecting the ignition anode with the solenoid B. The cock A connects the rectifier with the vacuum pump. It will be noted that the anodes are rounded, and, as will be seen from fig. 5, very highly polished, to remove all irregularities from their surface, which would be conducive to back-firing. This illustration shows very clearly the insulators and arc guides, as well as the method of fixing the latter.

Three sizes have so far been standardised for dealing with 300, 600 and 900 amperes continuously up to about 800 volts

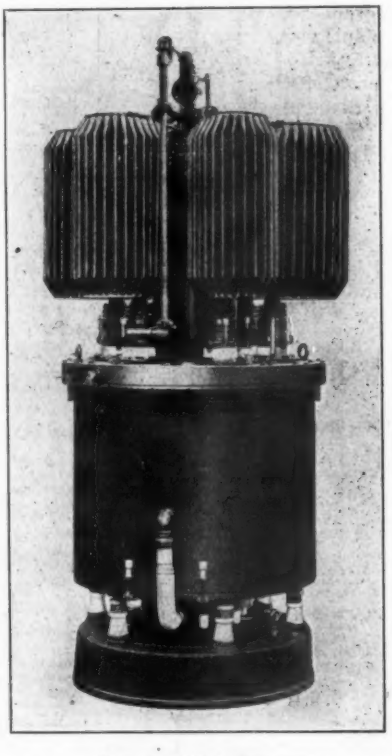


Fig. 6.—900-A Rectifier.

d.c. The largest size is shown in fig. 6, the medium size is similar in appearance but the smallest is not provided with the radiator coolers for the anodes. These coolers are insulated from one another and the rest of the cooling system while they are filled with water which is in actual contact with the top of the anodes and circulates on the thermo-siphon principle. For the higher d.c. pressures now coming into more general use for traction three further sizes have been developed to deal with 250, 500 and 750 amperes and pressures up to 1,600 volts. They are provided with rather higher working chambers; otherwise externally their appearance is the same as that of the low-pressure ones.

Auxiliaries.

A complete converter of this class consists essentially of the rectifier proper with its main transformer, the vacuum pump set, the ignition converter, the excitation gear and the anode or equalising reactance coil, where two or more rectifiers are running in parallel off one main transformer. The latter and the excitation gear have already been referred to; a few particulars will now be provided of the other parts which are all of importance in the operation of the plant.

Vacuum Pump Set and Gauge.

This is the most important of the auxiliaries, because a high vacuum is absolutely essential to satisfactory operation, and to obtain and maintain that required, an extremely efficient pump

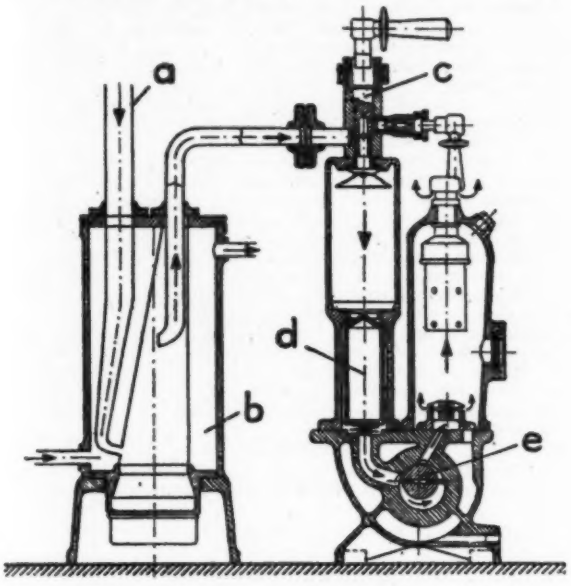


Fig. 7.—Section through Two-stage Vacuum Pump.

must be used and one of no ordinary design. In the rectifier the pressure is not the same in all parts but varies depending upon the temperature, so that near the cathode it is quite appreciable whereas in the cooler portions higher up it is very low, therefore, when we speak of a vacuum of 0.01 - 0.001 (the normal working range) it should not be inferred that this is the pressure inside the chamber; it is the pressure of the evacuated air at the surrounding atmospheric temperature as measured by the vacuum gauge. The readings are really a measure of the rarefaction of the air, which is what is desired, because the presence of air or gas in the rectifier adversely affects the ionisation process.

The pump set consists of a high vacuum mercury pump in series with a rotary oil-immersed pump, fig. 7. The latter pump is direct coupled to a ½-h.p. motor, and is capable of creating a vacuum of about 0.02 mm. Hg. The final reduction to 0.001 mm. is obtained by the mercury pump. This pump has at its base a pool of mercury which is electrically heated. The connection to the rectifier is by way of the pipe *a* which passes through the water jacketing *b* to the lower part of the conical chamber. It may be said to work on the injector principle, this action being obtained by the vapour rising from the mercury as it boils, and in doing so sucks the air down the pipe *a* and then carries it to the upper portion of the conical chamber where it (the vapour) is condensed by the cooling water, leaving the air to be extracted by the rotary pump and finally discharged to atmosphere. The working portion of the rotary pump consists of the eccentrically displaced drum *c* with slides which are completely oil immersed. In the event of the pump being accidentally stopped the aluminium non-return valve *d* would act due to the pressure of the atmosphere and prevent the oil passing into the vacuum pipe. The combined pump set with gauge is mounted on a common base-plate standing on a number of insulators, fig. 8. The reason for insulating from earth will be clear when it is realised that the set is in contact through the vacuum pipe with the rectifier which is statically charged.

The gauge used for the measurement of the high vacua is McLeod's, the principle of which is based on Boyle's law, *i.e.*, $pv=c$, and is shown diagrammatically in fig. 9. The left-hand sketch represents the arrangement when not in use and shows the measuring bulb *c* free to fill with the mixture of air and gas from the rectifier through the tube *a*. To take a reading the mercury bulb Hg is drawn upwards by suitable winding mechanism and the mixture in the measuring bulb is forced by the rising mercury into the capillary tube *k*. This is continued until the mercury in the tube *l* is level with the top of the capillary tube. There is then a difference of level *h* between the two columns which is a measure of the pressure in the rectifier. Very small differences can be ascertained in this way, while the scale can be graduated to give direct readings of the vacuum.

Ignition.

Compared with the operations required in the starting up of rotary converters the rectifier is without doubt simpler and presents many advantages. The ignition current is provided by an auxiliary 0.5 kW converter set, though under certain conditions it has been found possible to ignite by alternating current.

Referring to the sectional view of the rectifier, fig. 4, the ignition anode is seen to be some 8 mm. above the surface of the cathode, and connected to the solenoid at the top of the condensing chamber. A push button switch on the operating panel controls the ignition circuit and when depressed a current of about 2.5 amperes passes from the small converter through the solenoid coil thus causing its core to be pulled downwards against the pressure of a spring, until the ignition anode touches the mercury. The connections are so arranged that when this occurs, the coil is short-circuited and the anode is pulled up again by the spring. An arc starts at the point of separation and immediately afterwards the main arc commences and the set is switched on to the bus-bars. With rectifiers that are constantly in service this is all performed in a second or two, no preliminary operation being necessary beyond the checking of the vacuum. For the case of a plant that may have been shut down for some time, say 24 hours or more, it is advisable not only to make sure of the vacuum, but to separately load the anodes for a few minutes on to an auxiliary resistance supplied for the purpose, the object being to heat them up to ensure that they all take the same load. As an example of the speed with which rectifiers can be put on load the case may be cited of the 800-kW, three-cylinder set at Berne, where the average time for all three rectifiers is five seconds.

Parallel Operation and Regulation.

The operation of several rectifiers in parallel is very easily accomplished by electrically interlinking the anode or equalising reactance coils through an auxiliary winding on the latter, which ensures that the current divides equally among the anodes in parallel. Where each rectifier is provided with a separate transformer these anode coils can be dispensed with, the transformers being designed to give the desired regulation.

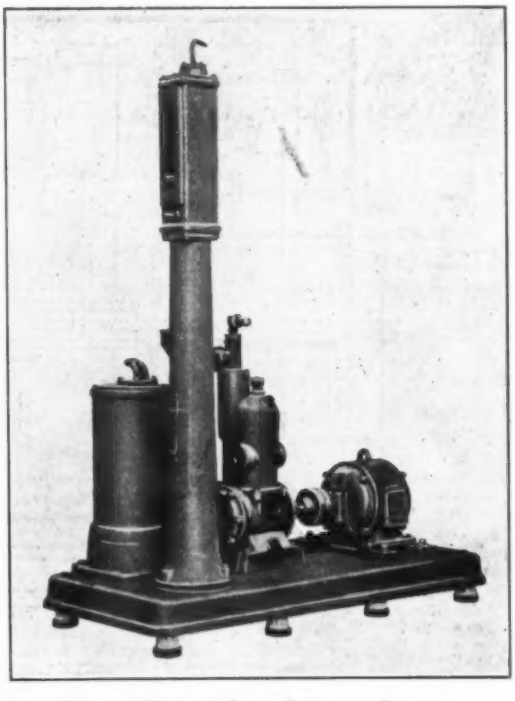


Fig. 8.—Vacuum Pump Set with Gauge.

To enable rectifiers to work well in parallel with other types of converters both must necessarily have approximately the same regulation characteristics, this requirement not being peculiar to rectifiers but applying to all electrical plant operating in parallel. To deal with higher loads than can be handled by single rectifiers it is customary to connect two or three in parallel, all being fed by one main transformer. Such a combination would constitute one set and be equivalent to a rotary converter set of like capacity. Each rectifier would be provided with its own low-pressure panel and though the switchgear is to some extent duplicated there is the advantage that during periods of light load one or more of the rectifiers can be shut down. Another very decided advantage

is that the factor of safety is considerably increased because taking the case of a three rectifier set for example, should one fail for any reason, it is still possible to deal with two-thirds of the load. Fig. 10 indicates a typical diagram of connections for an equipment consisting of three rectifiers with one main transformer, which would have a d.c. output of 1,500 kW at 550 volts if the largest size of rectifier is considered.

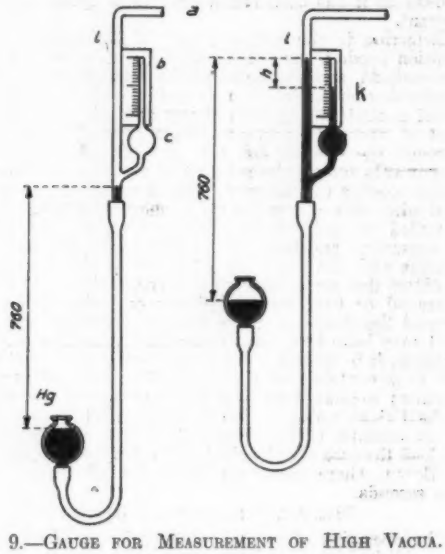


Fig. 9.—Gauge for Measurement of High Vacua.

The rectifier proper has no regulating properties apart from its transformer and auxiliary gear, except for a very slightly negative tendency of the arc with increasing load which makes it necessary to insert the anode reactance coils already referred to. In the normal equipment where close regulation is not required there would be an inherent pressure drop up to about 12 per cent. but this can be very materially improved by connecting a special form of reactance coil (cathode reactance coil) in the neutral of the transformer as seen at Cr in the diagram. To enable this coil to be used the transformer secondary is arranged as two three-phase star connected groups with the two neutral points brought out to the cathode coil. This coil has two sets of windings (with a common magnetic circuit) acting in opposition which produce a throttling effect causing the phase currents to overlap, so that at least two phases are made to function simultaneously. In consequence the r.m.s. value of the phase current is reduced and a smaller transformer can be utilised—thus the figure 1.6 previously given can be taken as 1.46. It will also be clear that if the r.m.s. phase current is reduced, the overall drop, which is proportional to the current, must decrease too, the usual figure obtained being 5-6 per cent. from very small loads of 10 to 15 amperes and full load, the two characteristics being similar to those depicted in fig. 11. It will be seen that curve *b*, which is that applicable to the cathode coil, rises very rapidly from the few amperes referred to and absolute no load, the difference amounting to about 15 per cent. As it is exceptional for plants to operate at such low loads this rise of pressure is of little moment. The peculiar form this curve takes is due to the magnetisation of the coil, which only reaches the value at which the throttling effect is a maximum and overlapping of the phase currents takes place, when the curve bends and takes its normal course.

A plant relying for voltage control on a cathode coil is one to be commended because it is simple and gives as close regulation as is needed for average conditions, but where it is desired to maintain the d.c. pressure constant at all loads or to increase the pressure with the load, other means must be adopted of obtaining this. As the ratio between a.c. and d.c. voltage is fixed it is necessary to vary the former either on the primary or secondary of the transformer. One method, and that shown in the diagram (fig. 10), is by means of tappings and a step switch, but the invariable way, however, is to use an induction regulator (hand or automatically controlled) either three-phase on the primary of the transformer or six-phase on the secondary, by which means any degree of regulation can be given according to the capacity of the induction regulator chosen.

Overload Capacity.

The overload capacity of a rectifier, given equivalent conditions, is not inferior to that of any other class of converter—in fact it can be definitely stated that it has qualities in this respect that are superior. Load variations of whatever degree, can be handled with the greatest ease, while momentary overloads of 200 to 300 per cent. are dealt with very quietly. The same can be said for short circuits, the only indication that such have occurred being the readings of the instruments and the tripping of the circuit-breakers.

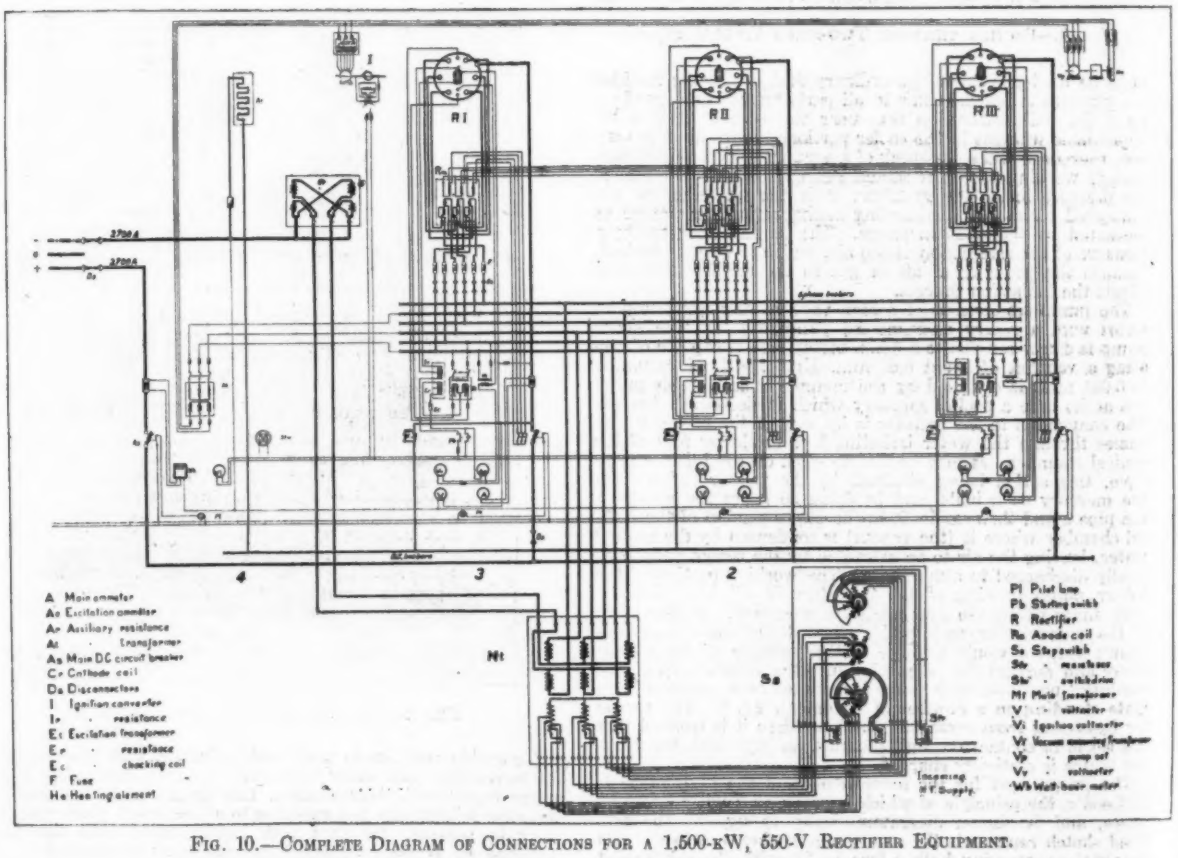


Fig. 10.—Complete Diagram of Connections for a 1,500-kW, 550-V Rectifier Equipment.

(To be continued.)

ROTARY CONVERTERS: WITH SPECIAL REFERENCE TO RAILWAY ELECTRIFICATION.

By F. P. WHITAKER, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

It will be advantageous in this country for the frequency of the supply to railways to conform to the standard frequency of 50 periods per second, except when the railway will pass through districts in which the frequency has been decided by the large developments that took place prior to the standardisation of a frequency of 50, in which case it would be advantageous for the railway supply to conform to the frequency of the district.

Converting apparatus will, therefore, be required to operate from generating stations supplying power at frequencies of 25, 40 and 50 periods per second, and will probably deliver power to the trains at a d.c. pressure of 1,500 volts. Abroad, requirements may demand an operating pressure of 3,000 volts (d.c.).

The rotary converter has become the recognised conversion unit on 600-volt railway systems operating from 25-, 33- and 40-period systems, and this paper was written with the object of showing how far the modern rotary converter specially developed for the more exacting requirements of 1,500-V d.c. is capable of fulfilling these conditions of service even when operating from 50-period systems.

With regard to the maximum permissible value of the average voltage per segment, I would suggest approximately 13 volts for the higher-frequency rotary converters, and 15 volts for the lower-frequency machines. With regard to limiting peripheral speeds, from 4,000 and 5,000 ft. per minute are now considered normal. Speeds of 6,000 ft. per minute have consistently given equally satisfactory service. Speeds of 8,000 ft. per minute have been used experimentally over prolonged periods with heavy loads with excellent results. The maximum d.c. voltage that can be conveniently generated in a rotary converter with a single commutator is approximately:—

3,500 volts for 15 periods per sec.
2,000 volts for 25 periods per sec.
1,500 volts for 33 periods per sec.
1,300 volts for 40 periods per sec.
1,000 volts for 50 periods per sec.

So that, while on 25 periods the generation of 1,500-V direct current has been accomplished in single-armature converting units, and such practice can be extended up to approximately 33 periods, above this frequency it is necessary to connect two 750-V rotary converters in series, or one single-unit motor converter could be used.

The generation of 3,000-V direct current will generally be associated with a supply frequency of 50, and probably with relatively long alternating-current transmission. For such duty the synchronous motor-generator set is the most serviceable unit. The voltage of 3,000 could be generated on one commutator, providing the frequency of the generator were kept down to about 15, but it is more economical to connect two 1,500-V generators in series, each generator operating at about 25 periods per second.

The general proportions of both 25- and 50-period converters will not be seriously changed with the increased voltages; the general operating characteristics, such as commutation, efficiency and power factor will remain unchanged.

The liability to flash over is to some extent controlled by the detailed design of the machine, but even when the most conservative figures for design are used high-voltage machines will flash over when subjected to short-circuits, if protected by the ordinary type of switchgear.

Owing to the energy of reversal in the short-circuited coils becoming too large, the saturation of the commutating flux path, and the high current density under the brushes, if the load on a converter is increased beyond a certain limit, serious sparking results. Also, if large loads be very suddenly applied, the normal balance between alternating-current and direct-current armature reaction is upset and this tends to produce sparking.

Under partial or complete short-circuits the machine has momentarily to withstand currents beyond the commutating limit, and the armature reactions are seriously unbalanced. This results in an arc being drawn between the commutator segments and the brush tips and adjacent metal parts.

While the short-circuit remains on the machine the terminal voltage is very low, but quantities of highly-conducting vapours are produced. As soon as a circuit breaker disconnects the external short-circuit and allows the voltage around the commutator to increase, an arc strikes through this conducting vapour and forms a local short-circuit around the commutator. This short-circuit again reduces the voltage and the arc is quenched. The voltage again increases and, if sufficient conducting vapour be still present, the arc will again strike.

This successive striking of the arc may continue, especially on high-voltage d.c. machines, until the a.c. side is tripped out and the speed and field have been reduced by successive flashes.

Machines were built with a completely insulating and fireproof screen between the commutator and the rest of the machine, so that, in the event of flash-over, the arc would not penetrate into the more delicate parts of the machine. Good clearance was provided between the positive and negative brush arms, the operating details of the brush-gear were well protected, and commutation quite satisfactory up to three times full load.

These machines would take partial short-circuits up to about five times full load without flashing over, but above that point flashing over would result, and it was found advisable to reduce the severity of the flash by the use of instantaneous trips on the a.c. side of the machine. Later, various novel features were introduced with a view to making the machines still more robust and self-protecting.

The diameter of the commutator was made practically the same as that of the armature, the armature bars being sweated directly into the commutator. With this construction it was impossible for the conducting vapour produced under short-circuit to penetrate inside the armature and cause subsidiary short-circuits.

The armature was provided with a propeller fan just at the back of the commutator, so arranged that it directed a strong blast of air axially over the commutator surface. The d.c. brush-gear was completely enclosed inside cast metal brush-holders, which were practically immune from damage due to flash-over.

The following advantages of this construction have been proved:—

The conducting vapour produced under short-circuit is rapidly swept away by the blast of air, thus reducing the chance of flash-over when the d.c. voltage is restored on the opening of the d.c. circuit breaker. In the case of flash-over the resulting damage is almost negligible. The arc has not been known to re-strike. The conducting vapours are blown away from the important parts of the machine so that subsidiary short-circuits are not produced. The short-circuit is cleared so quickly that in most cases it is cleared by the d.c. circuit breaker, and the machine is left running on the a.c. side.

The following features were also incorporated in the design of these machines:—

The distance between the centre line of the armature and the base-plate was made as large as possible, so as to give a large clearance between the brush arm and the base-plate and provide for air space all around the commutator. The distance between the commutator and the bearing pedestal was made large, and the pedestal and base-plate were shielded with insulation, to prevent the arc striking to earth. No part of the yoke for the brush brackets projected over the commutator, and this yoke was separated from the commutator and brush brackets by a thick layer of insulating material. The commutator segments were provided with arcing tips to prevent the deterioration which takes place at the ends of the commutator bars during flash-over.

We have recently experimented with a construction for magnetically driving the arc from the commutator surface of a 750-kW, 1,500-V compensated generator. When protected with an ordinary type of circuit breaker it was found possible to short-circuit this generator completely when separately excited on the shunt winding, with or without the compound winding, without the slightest damage to the machine.

It would appear sound practice to construct all high-voltage machines so that they are as self-protecting as possible, and, if the short-circuit conditions are severe, the machine should be further protected by a high-speed circuit breaker.

For ordinary services where the range of voltage is of more importance than the ability to withstand sudden and large overloads without disturbing the commutation of the machine or the voltage of the line, quite large values of reactance may be used to advantage. In railway working, where little advantage is to be gained by the range of voltage or appreciable over-compounding, but where it is advantageous to keep the d.c. voltage as constant and the h.p. power factor as high as possible, and where it is necessary to reduce the momentary derangement of commutating conditions due to sudden loads, it is preferable to install machines compounded to give the same voltage at no load and 50 per cent. overload with a range of voltage from no load to 50 per cent. overload by shunt control not exceeding + or − 2½ per cent. Under such conditions the reactance can be kept relatively low. Machines designed on these lines would have characteristics up to three times full load.

If interference with communication circuits is to be avoided it is of importance that the d.c. voltage shall be as uniform

and free as possible from ripples and undulations. Oscillations in the d.c. pressure may be: (1) Natural, *i.e.*, those that exist in the d.c. voltage before the rotary converter is connected to the a.c. supply. (2) Connection oscillations, *i.e.*, those that result from connecting the rotary converter to the supply and assuming the supply to have a sine wave-shape. (3) Transference oscillations, due to the deviation of the supply wave from the sine wave-form, which are transferred from the a.c. to the d.c. system. (4) Load oscillations produced by loading the converter. These may be divided into: (*a*) Saturation oscillations, due to the current passing into the rotary-converter armature being forced to take a shape other than a sine wave-shape. (*b*) Resistance oscillations, due to the superposition of the alternating and direct currents. (*c*) Flux linkage and distribution oscillations, due to the resultant armature curents.

With a view to determining possible limits for these oscillations, records have been kept on all machines manufactured over a period of years, and the maximum deviation of the d.c. voltage from the mean, due to tooth ripple, has not exceeded + or − 1 per cent., and when the ripple has been known to be of importance it has been reduced to less than + or − ½ per cent. In fact, it has hardly been discernible in the oscillograph records. These values apply to the natural d.c. wave-shape, and, because corresponding ripples will be found in the natural a.c. wave-shape, when the rotary converter is connected to the supply the tooth ripple will be somewhat reduced, due to the wave-shape equalisation discussed in the next paragraph.

Oscillations due to connecting the rotary converter to the supply with sine wave-shape are usually quite small and of the order of + or − 1 per cent.

The d.c. voltage wave can be materially changed by the deviation of the supply wave from the sine wave.

In general, rotary converters operate from systems containing a large variety of synchronous apparatus, and this results in the wave-shape of the supply being practically sinusoidal, but in cases where rotary converters will operate from a station containing one class of generator it is very important that the wave-shape of such generators should closely conform to that of a sine wave.

The present standard rule for the wave-shape of a.c. generators is entirely unsatisfactory, but is now under discussion, and it is in the final interests of all concerned that a new rule be formulated covering load as well as no-load conditions in which tolerances are reduced to the smallest figure consistent with reasonable protection of the manufacturer's interests.

Such a rule might mean the discarding in future of certain types of windings on generators built for general power-distribution purposes, but I believe such elimination would be beneficial to the industry, for windings which give good wave-shapes between phases tend to produce generators of economical design.

The oscillations on the d.c side may be broadly classified as: (1) Tooth ripples. (2) Undulations with a frequency of 6 per period. (The oscillations of 12 times normal frequency are usually very small.) The tooth ripple on rotary converters for traction purposes need not exceed + or − ½ per cent. of the d.c. voltage ripple and, providing the supply conforms to a sine wave, the undulations of six times normal frequency need not exceed + or − 2 per cent. of the means d.c. voltage on full load, the deviation being slightly greater on overloads. In cases of interference which have come under the author's notice the deviations have been considerably greater than the above, and it is not to be expected that any appreciable interference will occur on well-balanced telephone lines with ripples and undulations of this magnitude and frequency.

Discussion in London.

Mr. Roger T. Smith, in opening the discussion, explained that the electrification of railways in this country was held up on account of the Ministry of Transport's railway grouping scheme. At present no company knew under what conditions it would eventually find itself. He also pointed out that the Ministry's Advisory Committee had advocated the use of a pressure of 1,500 volts at the sub-station bus-bars, and that a pressure of 3,000 or 750 volts would be allowed on the train if the Ministry considered it the proper thing to do so. The method of blowing out rotary converter arcs, that the author had described, was ingenious and the tests that he (Mr. Smith) had seen at the B.T.H. Co's. works were very effective. He had used 6,000/600-volt motor converters for 16 years with every success, and he thought they would be as good also at 1,500 volts. They were most useful and reliable machines for railway work. The second portion of the paper contained very valuable information on telephone line disturbance.

Mr. J. R. Cowie was of the opinion that mercury arc rectifiers had too many auxiliary devices connected with them. Something could be said for the synchronous machine, and a good deal for the La Cour converter. In any attempt to suppress flash-overs a high-speed circuit breaker must be added. He had not yet come across satisfactory a.c. slip rings or brushes.

Col. H. E. O'Brien, D.S.O., explained his experience of the early 1,250-kW, 25-cycle rotaries which at first gave serious trouble on account of flashing over; the fault was considerably reduced later when the compounding coils had been removed—probably due to the battery that worked in conjunction with the sub-station. Photographs of flash-overs often seemed to indicate that the flash was confined to one pair of brush arms, and did not cover the whole of the commutator. The author's machine had a considerable rival in the mercury arc rectifier, but the latter had a serious disadvantage in not being capable of being put on load suddenly; it required from 20 to 25 minutes for warming up. A rotary converter to run on a 25-cycle system and produce 1,500 volts was now obtainable, and he hoped it would not be long before they could get the same pressure direct from a 50-cycle system.

Another speaker pointed out that no mention of costs had been made in the paper; and his opinion was that reliability should be considered before efficiency. The limit of voltage per commutator bar as given in the paper was too low for a 50-cycle machine, and he did not agree either with the mechanical limits of the bars as stated in the paper. By the use of a radial commutator a peripheral speed of 11,000 ft. per minute could be attained, and a 50-cycle machine to produce 1,500 volts was now being built. In connection with the flash-suppressing shields used in the U.S.A., high-speed circuit breakers had assisted very much. The author's remarks on ripples were very valuable.

Dr. S. P. Smith thought it was rather late in the day to suggest the use of two machines in series. No doubt higher peripheral speeds would be used in future and with regard to the limit pressure between the segments, the figure given in the paper was too small as a good machine could be made with a pressure of 20 volts between the segments. The use of bars 3 mm. thick with 1.5 mm. of mica between them showed that their ideas must be revised. Dr. Smith wanted to know how the author had manufactured his harmonics. It might be that by the time they had learned how to build a h.p. high-power machine the mercury arc rectifier woud be in a position to oust it.

Mr. J. W. Ray wanted to know how much money was spent on overload ratings; that money never earned anything on the investment because the overload ratings were very seldom, if ever, really needed.

Mr. W. E. Highfield referred to the work that had been done in America on the subject of flash suppression as a retrograde step because it involved the placing of obstructions in the space between the brush arms. The author of the paper under discussion had reversed that policy.

Major A. M. Taylor said that as a description of a means of obtaining thoroughly satisfactory working on a single commutator at 750 volts under all conditions the paper deserved the fullest praise, but on the question of the voltage to be employed for main line railway electrification he was forced to disagree. On a main line section between London and Birmingham there were at present some 15 passenger trains each way in a day of 12 hours. This gave a time headway of 0.8 of an hour per train, which, at an average speed of 45 miles per hour, would give an actual space headway of 36 miles between any two trains. The line being 110 miles long it thus divided up into approximately three sections, on each of which there would be two trains at any moment moving in opposite directions. The proper spacing for the sub-stations on such a line would be at 36 miles apart. At 1,500 volts, however, that would be quite impossible; in fact, each sub-station would have to be restricted to feeding a length of line represented by six miles, and even then the average loss in the feeders would be of the order of 10 per cent. Therefore, assuming that each locomotive took 1,000 kW, the total energy required for the whole line was only 6,000 kW, but 18 rotary-converter equipments, each of 2,000 kW = 36,000 kW, would have to be used, or six times the generator power necessary in order to deal with that, and under the worst conditions at any moment only three of those sub-stations might be in full operation and the other 15 idle. The efficiency of the rotaries under such conditions would be extremely poor.

If, however, they employed single-phase locomotives (assuming they could operate at 11,000 volts), they would need three static transformer sub-stations, each to supply 36 miles of track and each of only 2,000-kW capacity, or a total capacity in static transformer sub-stations of 6,000 kW. Now, the cost of a static transformer was roughly one-sixth that of a rotary converter plus static transformer, and, as six times the total kilowatt capacity was required, it meant that they would be paying 36 times the price, in the case of the rotary converter sub-stations, that they would be paying in the case of the static transformer sub-stations; the cost of the distributing feeders being about equal in the two cases.

The difference in efficiency between the single-phase and d.c. locomotives, at full speed on the level, was only about two per cent. Therefore they should either not consider main line d.c. electrification solved until they could at least distribute at 3,000 volts (preferably at 6,000), or, alternatively, give a reasonable hearing to single-phase a.c. proposals.

Another speaker thought the author's idea of fitting a fan to blow the dust and vapour away was primitive; it would have to be removed whenever repairs were necessary to the

windings and such removals might upset the balance of the machine. A magnetic blow-out was a much more scientific method. The inherent disadvantages of the converters described in the paper made a good case for the a.c. single-phase system of railway electrification.

Mr. S. C. Bartholomew, speaking from a telephonist's point of view, was glad to hear that ripples could now be reduced. Suppliers of power seemed to overlook the fact that a few micro-watts might seriously affect telephone circuits, and that the trouble was cumulative. If ripples could be reduced to the extent indicated by the author, it was very unlikely that there would be any trouble with Post Office lines.

Mr. F. P. Whitaker, in reply to the discussion, exhibited lantern slides referring to tests that had been carried out after the paper had been printed. The machines illustrated were eight of those that were to be installed in the automatic sub-stations of the Victorian railways in Australia, one being a 4,500-kW, 500-volt machine, probably the largest built for that pressure. It was impossible to convert a bad machine into a good one by the incorporation of a high-speed circuit breaker; the design must be first improved and then the breaker might be added as a refinement. He had experienced no trouble whatever with arcing on the a.c. side or slip rings. They had done well in the past by keeping the voltage per bar low and in the U.S.A. there was now a tendency to reduce that pressure rather than to go on increasing it. When damped machines came into use in 1913-14 telephone line troubles were increased; the tendency was to retain the damping, but to reduce the ripples.

THE IDEAL HOME EXHIBITION AND WELWYN GARDEN CITY

(*Concluded from page* 331.)

The system of warming rooms by means of heated panels in floors, walls, and ceilings is undoubtedly superior to any other method, owing to the full effect of radiant heat being obtained, in contradistinction to local warming by convection. The efficiency obtained by Messrs. Richard Crittall & Co.'s. "Panel" system of warming has directed research towards the application of electricity, with a view to obtaining similar results.

The result of the practical employment for many years of an extended area of surface maintained at a comparatively low temperature for warming purposes has proved that comfort can be secured by this means with an astonishingly small fuel consumption, and the invention of a relatively low-temperature heating element permits the use of electricity for warming at a cost far below, it is claimed, anything heretofore experienced. In addition, this method enables warmth to be applied to the room to be heated without in any way interfering with the scheme of decoration; in fact, the system may be termed "Invisible Heating."

Not only may walls, floors, and ceilings be heated in this simple and unobtrusive manner; it is equally easy to have one's heat transmitter in the form of curtains (to check cold draughts from windows), screens, footstools, mattresses, quilts, and even in chairs, settees, door panels, &c. The various applications of the system have been covered by letters patent granted or applied for.

It is not suggested that this method of electric heating, which has been developed by Mr. Grierson, will displace the generally accepted system of central-heating by low-pressure hot water, but there are many buildings where the installation of a hot-water system would be costly, or where occasionally in cold weather warmth is required in certain rooms or additional heat is necessary to supplement an open fire or other existing method of heating. In these cases, the "Electric Panel" heating system will fulfil the need without difficulty and, it is said, at a comparatively small cost. As in many cases the lighting of fires will be unnecessary, an appreciable saving will be made in domestic labour, and depreciation of the contents of rooms is prevented owing to the absence of smoke and dust from coal fires.

This system has the outstanding advantage that no pipes, radiators, &c., are visible, and architects will at once appreciate its convenience of application to decorative schemes. Owing to the extremely low temperature employed, no depreciation takes place in the material used and, therefore, the cost of maintenance is claimed to be nil.

The general impression that, in spite of its desirability, electric heating is much too expensive for ordinary household use is now rebutted, as it will be found that the cost of this new system of heating compares very favourably with that of gas and coal fires. This is due, chiefly, to the fact that other forms of heat generation, such as gas and coal fires and the types of electric radiators commonly in use, employ small surfaces, operating at comparatively high temperatures, which overheat patches of seating accommodation in their immediate vicinity. Conversely, "Electric Panel" heating, being distributed over large areas at a low temperature, diffuses a gentle warmth throughout the apartment which, whilst being distinctly perceptible to the individual, does not unduly warm or dry the air. Moreover, the warmth is not lessened materially by the opening of windows, as the high-temperature stratum of hot air at the ceiling, which normally obtains with the older methods of heating is, we are told, absent when this system is employed.

Messrs. Siemens Brothers & Co., Ltd., are showing a room wired for electric lighting, heating, &c., on the "Stannos" system. Included in the exhibit is a model in which the application of this system of wiring to housing schemes is demonstrated. It shows a transformer installed in the nearest cottage to the main power cable; from the low-pressure side of the transformer a "Stannos" conductor is carried along the outside walls of each group of cottages and the supply tapped for each cottage through the main wall. Between each group of cottages the "Stannos" main is buried directly in the ground. One of the leading advantages derived from introducing electricity into groups of cottages by this means is the reduction of cost, as the system dispenses both with the necessity for opening the road and laying a main cable, as well as opening trenches for laying the service wire into each of the cottages. In several housing schemes, which at present are in progress, this economical method of introducing electricity supply is being adopted.

The Benefit Supremophone is an improved gramophone which makes possible continuous music without attention. It uses ordinary records and needles and can be supplied either spring or electrically-driven; the desired number of records having been placed in the magazine, the machine is started and goes through the whole programme without further attention. The records are automatically fed, placed, and filed away; additional records may be added to the magazine while the machine is functioning without breaking the continuity, and by merely pressing a lever any record can be repeated any number of times, or the repetition can be made at any desired point in the record. The whole mechanism is simple and in no way interferes with the tone of the instrument.

The Telephone Manufacturing Co., Ltd., has a large display of automatic intercommunication telephone instruments for use in the office, home, and factory. Loud-speaking telephones which dispense with hand-sets are shown, and the "Laryngaphone" is noteworthy for its feature of defying noise that interrupts conversation.

The Sheringham Daylight Development Co., demonstrates how light from an ordinary electric lamp can be converted into what is described as "pure daylight" by means of a simple specially coloured reflector that requires no alteration of the existing installation. On the stand several types of lamps and fittings suitable for both domestic and industrial use are to be seen.

Berry's Electric, Ltd., has an attractive display of electric heating, cooking, clothes- and plate-washing appliances in addition to a large selection of electric household utensils on view in "Touchbutton House."

On the stand of the Metropolitan-Vickers Electrical Co., Ltd., there is naturally no room for any of the company's heavier industrial products and its exhibit has been confined to a display of fittings and useful domestic appliances, like electric irons, kettles, and fires. In addition to the well-known "Cosmos" bowl fire, we noticed the new 2-kW fire for general rather than directional heating, about which there are many excellent features. Some mention must be made of the fittings displayed; many of these manufactured at the company's Birmingham works (Harcourts, Ltd.), are very artistic. The exhibit has not been spoilt by over-crowding, the general arrangement being excellent.

From the large and varied display of domestic electrical appliances for heating, cooking, and lighting as well as the number of dish- and clothes-washing machines, clothes ironers, sewing machines, vacuum cleaners, &c., the most fastidious should find no difficulty in making a selection; such devices multiply at an astonishing rate and we must content ourselves by merely mentioning the names of the exhibitors:—British Electric Transformer Co., Ltd. (cookers and fires); Vickers, Ltd. (electric sewing machines); Jackson Electric Stove Co., Ltd. (cookers and heaters); Dowsing Radiant Heat Co., Ltd. (domestic, commercial, and medical heating appliances); Belling & Co. (fires and cookers, including an imitation coal fire and a vestibule fire, both fitted with "Multi-parabola" fire bars); Carron Company (cookers and fires); Falkirk Iron Co., Ltd. (cookers); L. G. Hawkins

and Co., Ltd. ("Universal" heating and cooking appliances, and "Miller" lighting fittings); Blue Bird & Simplex Electric Co. (electric clothes washing and ironing machines); A. W. Gamage, Ltd. (heating devices); Singer Sewing Machine Co., Ltd. (electric sewing machine); Northern Steel and Hardware Co., Ltd. (washing machines, vacuum cleaners, irons, &c.); Electric Suction Cleaner Co. (vacuum cleaners); Beatty Bros., Ltd. (washing machines); Frank Feesey & Co. (washer, ironer, and drying cupboard, all electric); Electric Appliances Co., Ltd. (vacuum cleaners); Sun Electrical Co., Ltd. (clothes-washer, ironer, dish-washer, fires, and electrical utilities); Hoover Suction Sweeper Co., Ltd. (vacuum cleaners); Western Electric Co., Ltd. (dish and clothes-washers, ironer; sweepers, motors, sewing machine, &c.); Gillespie & Beales (suction cleaners); Electrical Utilities, Ltd. (heating and cooking devices); Duncan Watson & Co. (vacuum cleaners, washers, and ironers, and electrically-driven gramophone); Electrolux, Ltd. (electric sweeper and floor polisher); and H. Hogg (Olipel water heaters).

The Hotpoint Electric Appliance Co., Ltd., in addition to a collection of electric heaters, cookers, and vacuum cleaners, exhibit a B.T.H. portable wireless receiving set. This is a compact apparatus measuring 13 in. by 14 in. by 5 in., and weighing 18 lb. It is so simply arranged that no previous knowledge is required on the part of the user. A wide range is obtained with the set, and such outlying stations as Lyons, Paris, Nauen, Stavanger and Rome can be picked up quite easily. It can be readily adapted for the receipt of wireless telephony when supplemented by a small aerial equipment. An extended range may be provided for by the use of valve amplifiers and another accessory consists of a complete inker equipment to record Morse signals on a tape. Another B.T.H. device which is attracting attention is a time flashing device which is actuated four times daily by Eiffel Tower signals.

Finally, the British & Allied Electrical Agency, Ltd., is exhibiting "Lowa" dimming switches for controlling electricity; and Daniel Neal & Sons demonstrate the fitting of boots and shoes by means of an X-ray outfit, made by X-rays, Ltd.

The exhibition is being well patronised by the public and on the whole is a decided improvement on last year's show, especially with regard to the quantity and manner in which the electrical exhibits are displayed

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Fetish of the Quick-make and Quick-break Switch.

I have been interested in reading the correspondence regarding the merits and demerits of the slow-make as opposed to the quick-make switch, and as a designer and manufacturer of both types for many years, and therefore, I hope, fairly unbiased, I should be glad to have an opportunity of adding my word. In my view, each type has its special advantages.

The slow-make switch is generally simpler and more massively proportioned than the quick-make type, and this makes for reliability. The contacts are without doubt better, as you can afford to make the grip strong, and the contact area therefore more secure; in addition, each passage of the knife wipes out dust and dirt, instead of carrying it in and causing wear, thereby gradually lessening the contact area, as it will do with a looser grip. This type of switch may be made workable by hand up to almost any size and number of poles, by the interposition of a compound lever or other power-gaining device, between the hand and the spindle.

The quick-make type of switch, if well designed, is a satisfactory piece of apparatus for sizes, say, from 10 amps. to 100 amps., or 200 amps. at most: but over this size, the spring movement is apt to be unwieldy and unreliable, in overcoming the necessary large contact grip. Springs may, of course, break, though a positive "follow-on" is to some extent a safeguard; also a spring under compression is safer than a tension spring, being less subject to breakage.

Undoubtedly, in the case of the slow-make switch there is a chance of the blades being pushed only partly home, but, like your correspondent Mr. Wynne, I consider that with a well-designed, slow-make switch, this partial contact would in most cases be as good as the normal contact of the quick-make switch, and in my case, at least, this is borne out by the very trifling number of replace blades and contacts ordered year by year for slow-make switches.

Generally speaking, I think most operators, skilled or unskilled, push the handle home till they hear the "click," or feel the dead stop.

In my opinion there will always be advocates of slow-make and quick-make switches, and I certainly see no reason to believe in the prophecy of another correspondent that the quick-make will oust the slow-make. The former has been on the market for many years, but the slow-make is "still going strong" and giving complete satisfaction to users.

Switcher.

March 13th, 1922.

I fear the letters on this subject are degenerating into advertisements. However, the sweeping inaccuracies made by some correspondents absolutely howl for contradiction.

No one can agree that a surface contact of half a square inch is on the low side for a 50-amp. switch, or 4 sq. in. for a 500-amp switch. A sectional area allowing for 750 amperes per sq. in. shows enough strength in h.c. copper, and that is what the "Cantie" is designed at.

Now as to "quick make" loosening or burning contacts, well, my firm has during the past 23 years supplied to the Admiralty some hundreds of thousands of quick-make knife switches, and as yet has never been asked to supply a spare contact.

Admiralty specifications are not considered on the light side, and springs must stand a test of elongation to 100 per cent.; my firm has been asked to supply spare springs though probably there was no need of them, simply because it is impossible to elongate the spring beyond about 15 per cent, and under such conditions no spring will tire.

In conclusion, when I purchase a tumbler switch for my own use I see that it has a quick make.

H. W. Cox,
Managing Director, Cantie Switch Co., Ltd.

Nottingham,
March 13th, 1922.

Some years ago—I think it was in 1905—I took out a patent for a 25- and 50-ampere size quick-make-and-break switch—curiously enough, almost simultaneously with the Cantie Switch Co. I was unable to get any firm to take up the manufacture of my patent on commercial lines, but the few that I had made up for my own use were very satisfactory, and completely solved the problem that I was up against at the time, which was the incessant burning away, by careless operation, of the blades and contacts of ordinary type d.p. ironclad switches used for the control of printing presses driven by motors of sizes between 5 and 10 h.p. The type of switch that the Cantie Co. shortly afterwards put on the market had a mechanical movement which was superior to my design, and I continued to use this firm's type of switch in preference to my own.

The rotary snap switch used very largely on heating and cooking appliances for years past is operated very much on the same principle as the pioneer d.p. power switches above referred to. I am surprised that so long an interval elapsed before the *quick-make* movement was adapted to ordinary tumbler switches, the improved type of which was first put on the market less than two years ago. I have always strongly advocated that *quick-make* switches should be used on all local lighting or heating circuits which carry a maximum working load exceeding two amperes. Even at the present day, one sees radiators and small cooking appliances put on the market fitted with antiquated ordinary tumbler-type switches; the only excuse one can find for such practice is that the cutting of prices of this apparatus has reached so extreme a limit that the few shillings extra cost for up-to-date control switches cannot be incurred. Talk of "Spoiling the ship for a ha'p'orth of tar!" I have known any amount of cases where consumers have complained of switches being "out of order" on their heating appliances, and the sooner the rotary snap type or the quick-make tumbler-type switches (of the two I consider the former the superior all round) are standardised by manufacturers and insisted on by the trade generally, the better for all concerned.

P. A. Spalding.
Engineer and Manager

Electricity Works, Dundalk.
March 13th, 1922.

Mr. Denny has undoubtedly opened up a very delicate subject, and at the moment when almost every manufacturer of switches (tumbler and ironclad power types) is earnestly engaged on the production of an ideal type of double quick action switch for general use at a reasonable price. This, of course, is a natural advancement in electrical control gear. The object to be attained is the elimination of the personal element between operating and operated, the operated members (electrical control) being so designed as to function under an ideal condition; while this has been greatly advanced on oil switch-gear controllers and remote control, the more elementary types of switches have been neglected, and are to-day little better in design than 10 years ago. No doubt the war was responsible for the demand for double-quick action switches for general industrial uses. There have been excellent such switches available for at least 10 years; by excellent I mean switches built for hard service and having plenty of

metal, ample room for wiring, and proper shielding to confine the arc. It is to be regretted that the more recent types now being largely advertised are very poor specimens. It seems to be a case of how much can be left out of a switch and how many pretentious devices the electrical public will accept. For instance, Wiring: What has the contractor to say—perhaps he has said it? Shielding: Do the designers think that there is no arc with a quick-break action that they need barriers in name only? Mounting: Does the mounting of electrical parts on insulated metal parts overcome the necessity for allowing a safe spacing between poles?

I therefore venture to put forward an ideal specification for such a switch: Operating handle to work through an angle of at least 120 deg., to enable switches of the larger sizes (60-amp. 3-pole upwards) to be operated with normal constant pressure, the energy to operate the switch movement being stored up during two-thirds of this movement in either direction, the other third being the travel of the switch-movement and to have a positive follow-up in case of failure of spring.

The switch should not rely on the momentum of moving parts to carry the blade through the contacts, but be so designed that the pressure increases to a maximum just at the moment of making contact without the aid of momentum. As few springs as possible, say, one up to 60-amp. 3-pole or 100-amp. 2-pole; above these sizes, springs could be duplicated, but one spring should perform all the necessary functions.

The handle should have no lost motion, and must always indicate the position of the switch by having stable positions only at its extreme positions; it should operate in the same direction as the switch blades, interlock the lid, and must not project outwardly to cause obstruction. The mechanical movements should be separated from the electrical; each pole of the switch should be well protected to confine the arc between poles and pole to case. Ample room for wiring without kinking of cables, terminals to be suitable for cable sockets or direct clamping, easily removable from circuit without disturbing conduit, &c. A range of switches embodying practically the whole of the above features is about to be put on the market, and I believe at a price very little more than the cheapest.

I have seen one under an endurance test, and believe there is a great future for it, especially among the heavier industries, such as shipyards, docks, steelworks, collieries, &c., where the average operator also has the more mechanical controls to deal with, such as steam regulators, brakes, clutches, &c.

B. I. F.

Birmingham,
March 13th, 1922.

Cooling Systems for Liquid Controllers.

The colliery, in which the writer is employed, has a number of three-phase haulage motors, mostly of 150 and 250 h.p. output. They are operated by Allen, West and Westinghouse controllers.

The haulage roads are very steep, and trouble is being experienced in obtaining sufficient water for cooling purposes, especially when a haulage room is located near the top of one of the headings.

It is proposed to standardise in some kind of thermo-siphon system, and the writer would be extremely obliged if any of your readers would supply any data on the subject.

A "head" would have to be obtained, not by going directly vertical, for obvious reasons, but by taking the storage tanks up the headings until sufficient "head" was obtained.

The motors have the usual haulage conditions, *i.e.*, heavy load for a short time followed by intervals of rest; at the end of a shift they are only normally warm, so that the average loads are not above the ratings.

If any reader can help by giving a fairly comprehensive description of a successful installation, his assistance will be greatly appreciated.

Fuel.

March 13th, 1922.

Christianity and Industry.

In view of the present unemployment I beg to suggest that all disengaged men write to their members of Parliament pointing out the necessity of urging the Government at once to bring in an emergency law making it illegal for any employer to engage a man who is already in work, to compel the employers to take up disengaged men first, especially in the electricity supply industry.

During the war the Government made it illegal for any employé to leave his employer, which was not necessary; it was no doubt a move on the part of the employers (it will be well to remember this at the next general election). Now, when something useful in the way of compulsion on the other side is wanted, the Government does nothing; this is particularly rough on staff men.

Live and Let Live.

March 13th, 1922.

Charges for Services.

Perhaps the enclosed letters may be of interest to your readers. I have not received any reply to my letter of February 6th, so that it is quite fair to presume that the local authorities are fully aware that the charges are illegal. The details of charges are as follows:—

	£	s.	d.
2 yards 19/18 armoured cable ...	0	6	8
1 pair B.I. cut-outs	1	18	6
2 ft. 1¼ in. gas pipe	0	3	4
3 bricks	0	0	4
¼ peck cement	0	1	0
2 ft. battens	0	0	11
	£2	10	9

As a matter of fact, there is less than two feet of armoured cable on my premises.

Wm. Ashwell.

Nottingham,
February 28th, 1922.

The City Electrical Engineer. *February 2nd*, 1922.

CONNECTING PREMISES.

I shall be obliged if you will let me have full details of the item, £2 10s. 9d., *i.e.*, price of "terminal boxes and cable," separately.

Will you also be good enough to let me know what Act and clause thereof authorises the Corporation to make charge for above?

WILLIAM ASHWELL.

Mr. W. Ashwell. *February 4th*, 1922.

CONNECTING OF PREMISES.

I have to acknowledge the receipt of your favour of the 2nd inst. with reference to our charge of £2 10s. 9d. for the cost of the material used in connection with laying the service into your premises. In reply, I beg to enclose herewith the counter-leaf of the application form you signed at this office when applying for the supply, from which you will see that you undertook to pay the expense of providing and laying so much of the service line and fittings laid within your premises.

I enclose particulars of the amount of £2 10s. 9d.

H. TALBOT,
Electrical Engineer.

The City Electrical Engineer. *February 6th*, 1922.

CONNECTING PREMISES.

Your favour of the 4th inst. to hand. Unfortunately it only complicates matters, and you have not replied to the main question at all.

You originally charge for "terminal boxes"; now you call them "B.I. cut-outs." Will you be good enough to state definitely whether they are the "undertakers' safety fuses" or "consumers' terminal boxes," and if the latter, do you expect me to pay for boxes to which I am not allowed access?

According to the regulations A24, A25, A26, there appears to be no doubt whatever that it is the duty of the Corporation to themselves supply the "safety cut-outs."

In the event of the Nottingham Corporation having a special Act which authorises the charge, I wish you to supply me with a copy of the clause.

As to the last paragraph of your letter, a safety cut-out is not a "fitting," therefore you are in error in stating that I have undertaken to pay the expense of same.

I shall be glad to have your well-considered reply at an early date, and this in writing if you please.

WILLIAM ASHWELL.

It is certainly high time the rights of electricity supply authorities as touching charges for services were made clear to the public. I have been connected with two cases south of the Thames where exorbitant charges have been made, and not merely this, but in each case the contractor was quoted a higher price than the prospective consumer, the supply company having an installation department.

In one case the charges for the service involving approximately three yards of twin cable for six lights were £8 10s. and £9, more than the cost of the installation itself.

It would be interesting to hear from other contractors who have experienced the same kind of valuable assistance from their supply friends, and we shall expect to see one or two communications in your columns on the subject from mains engineers concerned explaining on what basis charges are arrived at. It is ludicrous that the contractor, when asked by his client whether the supply people will charge for running the service, should have to give them particulars of the customer's name and address, knowing full well that their installation department will be down on him next day for the order for the wiring at a cut price.

Bitten.

February 25th, 1922.

The Curse of Noise.—The Medical Correspondent of *The Times* says that some recent studies have shown that there are few more active robbers of our energy and strength than noise. It was supposed that people got accustomed to noises which they heard frequently, and that thereafter they did not notice them. This idea will have to be modified. What we call "getting accustomed" appears, on closer study, to be a state of active resistance. We are refusing to hear, so to speak, and expending energy in the process. When illness comes, the stock of energy available for all purposes is reduced, and "not hearing" cannot be practised; the noises of the world we live in become unbearable.

There is now a demand by many employers of labour, who recognise how much waste noise is responsible for, for noise-reduction in factory life. The same need exists in office life, and, indeed, in home life. At the present moment we live more noisily than any of our ancestors—and unless we look to it, shall pay the penalty for our carelessness.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

5,553. "Electric meters." H. T. Worrall. February 24th.
5,555. "Electric horns, &c." W. J. Gooderidge. February 24th.
5,563. "Electric switch wall plugs." C. Oliver. February 24th.
5,579. "Head-lights for motor-cars." F. J. Smith. February 25th.
5,593. "Switches." R. Bosch Akt. Ges. February 25th. (Germany, February 28th, 1921.)
5,619. "Electric alarm bells." A. E. Osborne. February 25th.
5,620. "Adjustable time-lags for electric circuit-breakers, &c." W. L. Barber, W. G. H. Cox, and Midland Electric Manufacturing Co., Ltd. February 25th.
5,629. "Wireless telegraph and telephone systems." T. H. Kinman and H. J. Warner. February 25th.
5,630. "Coils, &c., for wireless apparatus, &c." W. E. Barber and H. J. Warner. February 25th.
5,637. "Electric incandescent gasfilled lamps, &c." General Electric Co., Ltd. (A. Just). February 25th.
5,662. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. February 25th. (United States, March 16th, 1921.)
5,676. "Head-lights for motor, &c., vehicles." W. Birtwisle. February 27th.
5,722. "Telephone-call indicator combined with sounder." P. J. Monks. February 27th.
5,732. "Sound signalling." C. S. F. Mellor. February 27th.
5,737. "Head-lights for motor vehicles." W. H. Ainge and F. Smith and E. H. Wheatley. February 27th.
5,749. "Electrically-heated laundry irons." H. Booth. February 27th.
5,751. "Multiple-way connectors for electrical conductors." G. A. Rendle. February 27th.
5,787. "Illuminated signs." E. C. R. Marks (McSavaney Co.). February 27th.
5,788. "Automatic head-lamps." W. F. Little. February 27th. (United States, February 26th, 1921.)
5,791. "Push-button switches." T. E. D. Bilde. February 27th. (Sweden, March 21st, 1921.)
5,800. "High-frequency signalling systems." Western Electric Co., Ltd. (Western Electric Co., Inc.) February 27th.
5,801. "Carrier wave transmission systems." Western Electric Co., Ltd. (Western Electric Co., Inc.) February 27th.
5,802. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co., Inc.) February 27th.
5,815. "Oil-trip switches and fused-switches." E. Dobson. February 27th.
5,833. "Jointing of stranded electric conductors." H. Hawkins and L. R. Lee. February 28th.
5,836. "Regulation of polyphase commutating motors." Forges et Ateliers de Constructions Electriques de Jeumont. February 28th. (France, April 5th, 1921.)
5,842. "Electric switches." R. A. Macaulay. February 28th.
5,843. "Supports for incandescent electric lamps." T. Clarke. February 28th.
5,849. "Method of connecting up and driving dynamos." T. Cooper. February 28th.
5,850. "Windings for electrical apparatus." C. V. Drysdale. February 28th.
5,870. "Junction boxes." G. McKinnon. February 28th.
5,909. "Revolving-dome electric alarm push bell." H. Gennings. February 28th.
5,924. "Automatic telephone exchange system." H. Baron (F. Aldendorff). February 28th.
5,925. "Thermostatic electric circuit controllers." British Thomson-Houston Co., Ltd. (General Electric Co.). February 28th.
5,928. "Diaphragms for Rontgenology." G. Pearce and Watson & Sons (Electro Medical), Ltd. February 28th.
5,929. "Instruments for measuring wattless component of energy in alternating current system." Chamberlain & Hookham, Ltd., and S. James. February 28th.
5,948. "Protective arrangement for dynamo-electric machines." English Electric Co., Ltd., and J. C. Wilson. February 28th.
5,951. "Decorative electric devices." H. H. Berry and C. A. Painton. February 28th.
5,980. "Ships' telegraph." J. Burn. March 1st.
5,982. "Electric motors for power traverses, &c." J. G. Stirk and R. Stirk. March 1st.
6,007. "Electric bells." C. Melano. March 1st.
6,008. "Pole for telegraph, &c., wires." J. E. Rutter. March 1st.
6,027. "Rheostat." Singer Manufacturing Co. March 1st. (United States, July 20th, 1921.)
6,049. "Electric lamps for road vehicles." A. A. Sandbrook. March 1st.
6,059. "System for pole-changing for polyphase induction motors." K. Kando. March 1st. (Hungary, March 2nd, 1921.)
6,072. "Thermostatic electric circuit controllers." British Thomson-Houston Co., Ltd. (General Electric Co.) March 1st.
6,073. "Electric circuit controllers." British Thomson-Houston Co., Ltd. (General Electric Co.) March 1st.
6,074. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. March 1st.
6,092. "Direction-finding apparatus for wireless telegraphy." G. W. Harris and C. E. Horton. March 1st.
6,101. "Electric conductors." H. C. Braun. March 1st.
6,102. "Electric contacts." H. C. Braun. March 1st.
6,103. "Signals and alarms." H. C. Braun. March 1st.
6,112. "Reception of wireless signals." H. J. Round. March 1st.
6,113. "Electric railway signal-repeating system." J. Bethenod. March 1st. (France, March 2nd, 1921.)
6,120. "Electrode holders for high-frequency electrical apparatus." J. B. Bower. March 1st.
6,122. "Electric interrupters or make and break switches." J. B. Bower. March 1st.
6,141. "Dynamo-electric machinery." H. F. J. Thompson. March 1st.
6,143. "Ships' telegraph systems." H. McKinnon. March 2nd.
6,151. "Combined electric cooker and water heater." T. R. Stancombe. March 2nd.
6,179. "Brake blocks, electric collector shoes, &c., for railway, &c., vehicles." R. P. Forster and J. W. Taylor. March 2nd.
6,188. "Electric lamps." W. E. Bladon. March 2nd.
6,192. "Method of controlling, &c., electric battery used with instruments for assisting the deaf." H. Marcussen. March 2nd.
6,202. "Electric switches." C. W. Denny. March 2nd.
6,205. "Means for supporting and insulating conductors of electric overhead distribution, &c., lines." G. V. Twiss. March 2nd.
6,222. "Electric motor-control systems." British Thomson-Houston Co., Ltd. (Compagnie Francaise Thomson-Houston). March 2nd.
6,232. "Reciprocating rotary electric switches." Hart Manufacturing Co. March 2nd. (United States, May 3rd, 1921.)
6,239. "Thermionic generators of high-frequency electric oscillations." E. Green. March 2nd.
6,240. "Signalling apparatus." W. M. Rolph. March 2nd.
6,250. "Magneto-electric machines." A. Massey-Allen and North & Sons, Ltd. March 2nd.
6,255. "Electric driving apparatus for vehicles." O. Kurz. March 2nd. (Austria, March 2nd, 1921.)
6,258. "Trolley wheels for electric tramways, &c." P. P. Berthet. March 2nd. (France, March 2nd, 1921.)
6,262. "Electric light baths." W. M. Edwards. March 3rd.
6,270. "Electric cable joint boxes." J. C. Lee. March 3rd.
6,283. "Reflectors for electric lamps for vehicles, &c." F. G. Warbrook. March 3rd.
6,289. "Electric switches." J. C. White. March 3rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

7,573. "Galvanometers." Telegraph Construction and Maintenance Co., Ltd., and J. Riddle. November 15th, 1920. (175,300.)
20,920. "Method of producing a paper-band covering for electric wires." V. Planer. October 15th, 1917. (149,006.)
23,123. "Windings for alternate-current dynamo-electric machines." F. Creedy. August 5th, 1920. (175,306.)
23,338. "Head-lights and electric bulbs therefore." J. M. Richardson. August 28th, 1919. (149,978.)
24,861. "Radio-receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.) August 16th, 1920. (Cognate application 23,964/20.) (175,315.)
24,166. "Electrolytic rectifiers." R. W. McClintock and D. McKinnon. August 19th, 1920. (175,316.)
24,278. "Electrical transformers." British Electric Transformer Co., Ltd., and J. Roothaan. August 20th, 1920. (175,318.)
26,156. "Apparatus for starting electric synchronous motors." Compagnie Générale Electrique. September 20th, 1919. (151,269.)
26,540. "High-tension ignition magneto." Etablissements, Decsse. December 27th, 1919. (156,075.)
29,310. "Submarine sound receivers." H. Baron (Signal Ges.) October 16th, 1920. (Convention date not granted.) (152,616.)
31,166. "Electric motors." Lancashire Dynamo & Motor Co., Ltd., and R. S. McLeod. November 4th, 1920. (175,355.)
31,318. "Continuity devices for metallic conduits and fittings for electric cables." Simplex Conduits, Ltd., and H. F. McLoughlin. November 5th, 1920. (175,358.)
31,641. "Electric resistance material and a process for manufacturing same." Automatic Telephone Manufacturing Co., Ltd., and P. N. Roseby. November 9th, 1920. (175,365.)
31,674. "Mercury vapour and like rectifiers." W. Tschudy. November 17th, 1919. (154,187.)
31,929. "Means for measuring electric current and more particularly for measuring the output of electric transformers." British Thomson-Houston Co., Ltd., R. C. Clinker, and H. S. Holbrook. November 11th, 1920. (175,381.)
32,039. "Electrolytic apparatus for preparing hypochlorite solutions." D. M. Rogers and A. T. Masterman. November 12th, 1920. (175,390.)
32,142. "Magneto-electric ignition machines." R. Bosch Akt. Ges. November 14th, 1919. (153,905.)
32,208. "Electrolytic cells." G. Harrison (Dow Chemical Co.) November 15th, 1920. (175,401.)
32,225. "Transmission circuits for wireless telegraphy and telephony." A. K. Macrorie, H. Morris-Airey, and G. Shearing. November 15th, 1920. (175,402.)
32,226. "Reception of continuous waves in wireless telegraphy and telephony." A. K. Macrorie and W. A. Appleton. November 15th, 1920. (175,403.)
32,233. "Cooling of dynamo-electric machines." W. M. Selvey and L. R. Moreshead. November 15th, 1920. (175,404.)
32,306. "Electrical heating units." J. H. Robinson. November 16th, 1920. (175,411.)
32,514. "Connecting up of electric conductors and devices in which connecting up of electric conductors is required." R. Lomax. May 13th, 1921. (175,418.)
32,558. "Magnetos for ignition purposes." M.L. Magneto Syndicate, Ltd., and G. A. Lister. November 18th, 1920. (175,419.)
32,609. "Three-position electric relays." A. B. Kendall. August 18th, 1920. (168,021.)
32,709. "High-frequency electrical apparatus." W. R. Bullimore November 19th, 1920. (175,427.)
32,734. "Fluorescent screens and methods of manufacturing the same." British Thomson-Houston Co., Ltd. (General Electric Co.) November 19th, 1920. (175,428.)
32,890. "Electric lamps operating with a luminous discharge." J. Pintsch Akt. Ges. November 21st, 1919. (154,199.)
33,017. "Method of and means for controlling the circuits of electro-lifting magnets." A. West & Co. and W. L. Wise. November 23rd, 1920. (175,435.)
33,048. "Electrical speed-regulator systems." Metropolitan-Vickers Electrical Co., Ltd. January 12th, 1920. (157,072.)
33,057. "Wireless audio-frequency receiving apparatus particularly for use with transmission from photographs." Title Insurance & Trust Co. June 4th, 1918. (154,531.)
33,141. "Inverted pole accumulator." M. Tsuji and S. Nakao. November 24th, 1920. (175,439.)
33,846. "Electrically-operated door-latch control and annunciator device." N. Fienberg and W. L. Wakeham. November 30th, 1920. (175,452.)
33,951. "Electrically-controlled signal-operating mechanism for railways and the like." McKenzie Holland and Westinghouse Power Signal Co., Ltd. (Compagnie Générale de Signalisation.) December 1st, 1920. (175,455.)
33,966. "Electro-plating metallic bodies." J. S. Groff. December 1st, 1920. (175,466.)
34,129. "Thermionic valves." Silica Syndicate, Ltd., and F. Reynolds. December 2nd, 1920. (175,459.)
34,201. "Induction coil systems." A. C. Gunstone. December 3rd, 1920. (175,460.)
34,366. "Fuses for electric circuits." W. de Renzi and J. Adamson. December 6th, 1920. (175,464.)
35,775. "Means for and methods of superposing electric currents of different frequencies upon existing alternating current systems." A. M. Taylor. December 21st, 1920. (Patent of addition not granted.) (175,489.)

1921.

436. "Contact springs for switching apparatus." Siemens & Halske Akt. Ges. May 29th, 1914. (156,526.)
892. "Electric pocket magneto lamps and the like." F. E. V. Le Tellier. January 10th, 1920. (156,805.)
1,540. "Telephone systems with mixed automatic and semi-automatic service." Relay Automatic Telephone Co., Ltd. December 31st, 1919. (157,817.)
2,307. "Insulators for conductor rails and the like." W. H. Meyrick. January 17th, 1921. (175,515.)
12,249. "Cord grip holders for electric wires." J. Y. Fletcher and E. L. Randall. April 28th, 1921. (175,565.)
13,173. "Method and installation for braking direct-current series motors with the recuperation of energy." G. Meyfarth and Soc. Anon. des Aetliers de Secheron. August 18th, 1920. (168,036.)
16,884. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. November 29th, 1920. (172,277.)
34,934. "Windings for alternate-current dynamo-electric machines." F. Creedy. August 5th, 1920. (Cognate application, 36,540/20. Divided application on 175,306.) (175,583.)